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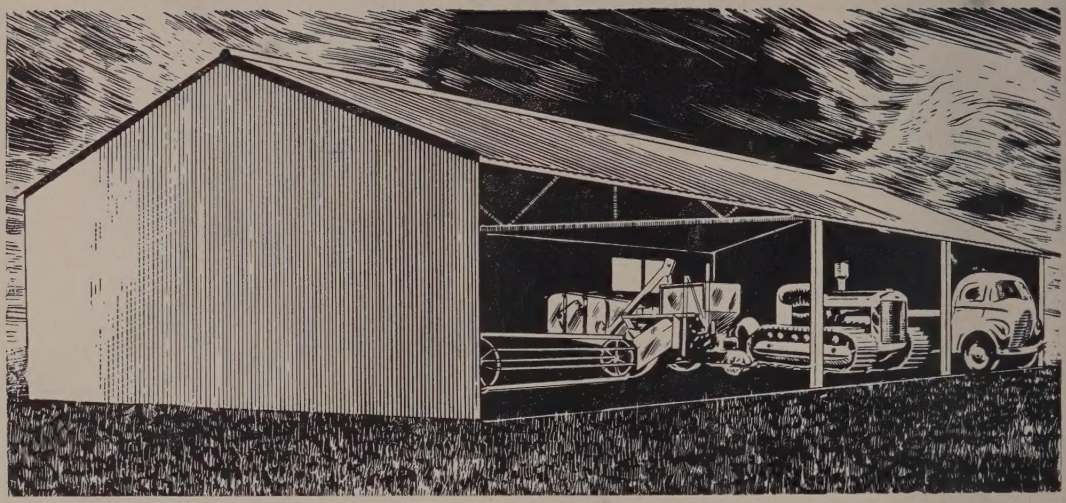

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The JOURNAL OF THE DEPARTMENT OF AGRICULTURE
WESTERN AUSTRALIA

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J. A. MALLETT

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COVER PICTURE

The Christmas Tree (Nuytsia floribunda) is a somewhat unusual member of the Mistletoe family in that it grows as a tree instead of merely as a parasitical attachment to the branches of other trees. It parasitises the roots of the host plant and its showy orange-coloured blossom is a feature of the early summer landscape. The Christmas Tree is seen at its best on the coastal plains of South-Western Australia.

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AGRICULTURE IN SOUTHERN AFRICA

Part 1—Mauritius and South Africa (including Basutoland)

By G. H. BURVILL, M.Ag.Sc., Commissioner of Soil Conservation (now Chief Plant Research Officer), Department of Agriculture, Western Australia.

Fig. 1.—New £A400,000 building for Faculty of Agriculture, University of Natal, Pietermaritzburg.

THE Fifth International Congress of Soil Science was held in Belgian Congo in August, 1954, because the International Society of Soil Science felt it was important for greater attention to be devoted to the problems of soils and agriculture in the tropics. The author, with three other Australian soil scientists, represented Australia at the Congress. While in Africa the opportunity was taken to spend several weeks in South Africa, and the Rhodesias, seeing various phases of agriculture, and particularly noting the methods used for soil conservation and extension (advisory services). Funds for this trip were made available from Commonwealth Extension Services Grant.

MAURITIUS

The trip to and from Africa was made by air via Cocos Island and Mauritius. Department of Agriculture officers were met at Mauritius, and during the 18-hour stop, they provided a most interesting glimpse of the island's agriculture. Mauritius was formerly a French possession but has been a British Colony since early in the last century. Schooling is still given in French, with English as a second language. The coinage is in rupees and cents. This island is about the latitude of Port Hedland and Townsville. Basalt mountains rise to 5,000 feet, and the extreme dimensions are 49 miles by 39 miles. Yet it supports half a million people and produces half a million tons of sugar per year. (South Africa now produces three quarters of a million tons and Australia one and a half million tons.) Many of the sugar fields have numerous neat mounds and lines of stones gathered together to allow planting and cultivation of sugar between them.

The rainfall varies from 40 inches to 150 inches per year, falling mainly in summer. The soils are of medium to heavy texture and mainly formed from the basalt. They are mostly dark brown or chocolate, but red soils occur in lower rainfall parts. Near the coast are some sandy fringes and beaches associated with the coral ring round the island. Tea, tobacco and hemp (from "aloe" *Fucraea gigantea)* are important crops, as well as sugar, but agricultural officers have been concerned about a decline in production of food crops, and the dominance of sugar in the island's economy. They would like to see more rotation of food crops with sugar, and enquired about Australian wheat varieties.

Interesting information was obtained about *Paspalum vaginatum,* a salt-tolerant grass which is proving of value in wet salt-affected areas in Western Australia. This grass grows in brackish swamps and marshes in Mauritius, and it is hoped to obtain seed from this source. The grass at present growing in Western Australia flowers freely in summer, but fails to produce seed.* It must, therefore, be planted from roots and runners. This grass is

*Early in 1955 a few viable seeds were collected, but in general it may be regarded as non-seeding.

called "salt water couch" in Mauritius and in America is called "sea shore Paspalum." The latter name is to be preferred in Western Australia, as the name "salt water couch" is commonly applied to *Sporobolus virginicus*. The *Paspalum vaginatum* in Western Australia is believed to have come orginally from South Africa, but no officer was met who was familiar with it in that country.

SOUTH AFRICA (INCLUDING BASUTOLAND)

General Information.

Going to, and returning from Belgian Congo, a total of nearly five weeks was spent in South Africa. The Director of Soil Conservation and Extension (Dr. P. D. Henning) organised a most comprehensive programme, including a day in Basutoland with officers of the British Colonial Service, who administer that native territory.

The Union of South Africa includes the four provinces, Cape of Good Hope, Natal, Transvaal and Orange Free State. Together they cover 472,000 square miles, or somewhat less than half the total area of Western Australia. (See map Plate 1.) From Cape Town to the Limpopo River on the northern boundary of Transvaal is about 1,000 miles; from Durban north-west to Mafeking is 500 miles. Under the Treaty of Versailles, the Union also administers South West Africa, a large area of dry country on the west extending 700 miles north of the Orange River.

The south-western part of Cape Province has a close similarity of coastal shape and latitude to the south-western part of Western Australia. It has likewise, a winter rainfall. The remainder of the Union is more comparable in coastline and latitude and rainfall with New South Wales and Queensland from Sydney to Rockhampton. But while high mountains and plateaux are restricted in Australia, they make up most of South Africa, where only a narrow coastal fringe has elevations less than 1,000 feet. The bulk of the farming and grazing land is 3,000-6,000 feet above sea level. The Drakensberg, on the borders of Natal and Basutoland, reach 11,000 feet. The inland winter climate is much colder than in Australia,

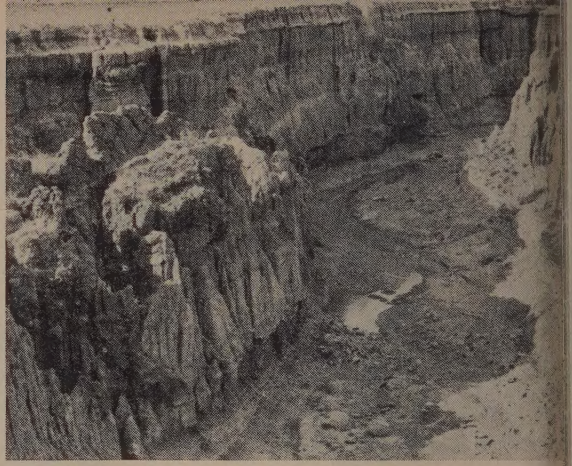

Fig. 2.—Erosion gully about 30 feet deep in overgrazed land. Senekal-Marquard area, Orange Free State.

and the mountain snows feed many rivers which can be used to irrigate dry areas. The rainfall varies from 4 inches in some of the desert areas to 70 inches in the mountains; a large area receives 20 to 60 inches, but most of the Cape Province gets less than 20 inches.

Wool is Second only to Gold.

South Africa is the world's greatest gold producer, and uranium is now also recovered along with gold. Gold exports are valued at £A200,000,000*, with wool at £A75,000,000 the next largest export item. The gross value of agricultural production, including animal products, in 1951-52, was about £A300,000,000.

Table 1 gives a general comparison of South African and Australian agriculture. Maize (called mealies in Africa), tobacco, groundnuts (peanuts) and citrus fruits are relatively much more important than in Australia. Wheat production is, however, relatively small at about 19 million bushels. Grape production in South Africa goes mainly into wine rather than dried fruits.

Though the Union has only 3 million white people, the total population is 13 millions. Most of the foodstuffs produced are consumed in the Union, so that apart from wool and skins and hides, agricultural exports are relatively small. Fresh, preserved, and canned fruit and vegetables, wines, tobacco, tannin extract, peanut oil and dairy produce are the most notable.

*Western Australia £A12,000,000.

Table 1.

COMPARISON OF AGRICULTURAL STATISTICS FOR SOUTH AFRICA, AUSTRALIA AND WESTERN AUSTRALIA, 1952–53.

Compiled from various sources in consultation with R. J. Little, Government Statistician, Western Australia.

Product.	Units.	South Africa.	Australia.	Western Australia.
Sheep	No.	36 million	123 million	12 million
Wool (total production)	Lb.	273 million	1,281 million	128 million
Cattle (beef and dairy)	No.	12 million	15 million	0·85 million
Butter	Lb.	74 million	375 million	15 million
Cheese	Lb.	23 million	104 million	2 million
Wheat	Bushels	19 million	195 million	35 million
Maize	Bushels	117 million	5 million	Very small
Sugar	Long tons	639 thousand	949 thousand	None
Groundnuts (peanuts)	Long tons	106 thousand	9 thousand	Very small
Tobacco	Lb.	44 million	6·5 million	1 million
Grapes (all purposes)	Long tons	480 thousand	560 thousand	17 thousand
Raisins and Currants	Long tons	10 thousand	98 thousand	3 thousand
Wine	Gallons	63 million	30 million	731 thousand
Citrus Fruits	Long tons	236 thousand	129 thousand	11 thousand
Apples and Pears	Long tons	68 thousand	246 thousand	33 thousand
Pineapples	Long tons	70 thousand	45 thousand	Very small
Canned Fruit	Long tons	47 thousand	96 thousand	Very small

Importance of a Sound Agriculture is Recognised.

Food is basic to human existence and few countries like to be too dependent on imported foodstuffs. South Africa—and the Rhodesias—recognise that food imports to them involve long ocean crossings, and ability to feed their people from home production is a vital objective.

Great concern has been felt in South Africa, about soil erosion and about the drying up of natural waters. Ten to 20 years ago it was recognised that much valuable soil was being lost under the farming and grazing practices being followed by black and white people. Water supplies from springs and streams were badly reduced in many places, apparently as a consequence of this faulty land management. Some investigators believe that the drying up of South Africa was partly due to a relatively dry cycle of years from 1905 to about about 1940*. Tree plantings to offset South Africa's great deficiency of timber, have also been blamed.

The importance of food and soil and water is reflected in the agricultural services provided from public funds for education, research and farm advisory services. In addition, direct cash subsidies are provided for a wide range of soil conservation and farm improvement practices.

In 1952-3 South Africa's expenditure from revenue on agricultural services for white farmers was £A5,530,000 (including agricultural education and experiment stations). In addition loan funds totalling £A2,000,000 were allotted for various purposes, but largely for soil conservation loans and subsidies to farmers and for expenditure on State soil conservation works. Some comparative figures for Australia are:—

Expenditure From.	Revenue. £	Loan. £
Western Australia—		
Department of Agriculture, 1953-54	678,000	32,000
New South Wales—		
Department of Agriculture, 1953-54	2,837,000	145,000
Soil Conservation Service, 1953-54	281,000	249,000
C.S.I.R.O., 1953-54	3,615,000*	

The white population of South Africa is similar to that of New South Wales. It has 118,000 rural holdings covering 200,000,000

*See Wicht, C. L., Forestry and Water Supplies in South Africa; Union of South Africa, Department of Forestry, Bulletin, No. 33, 1949.

*This is C.S.I.R.O. expenditure of public funds. It also has funds from various primary and secondary industries. C.S.I.R.O. expenditure is not all on agriculture, though a large part is.

Fig. 3.—Bush veld near Potgietersrus, Transvaal. Cattle are grazed on such land.

acres compared with 73,000 totalling 170,000,000 acres in New South Wales. Western Australia has 20,000 rural holdings.

Organisation of the Union Department of Agriculture.

The South African Department of Agriculture was reorganised a few years ago on a regional basis. After an extensive agro-economic survey of the Union had been made, eight regions were defined as shown on the map of Plate 2. Each region embraces an area whose climatic soil and topographic conditions, as well as its farming systems and pattern, are not repeated outside the region. The research and services of the Department have been co-ordinated with the faculties of Agriculture in the Universities of several regions. Thus at Pretoria, the Director of the Transvaal Region is Professor H. B. Davel of the University of Pretoria; at Stellenbosch, Dr. M. H. Slabber of Stellenbosch University was, at the time of my visit, Acting Director of the Winter Rainfall region. At Pietermaritzburg, Dr. A. R. Saunders, of University of Natal, is Director of the Natal Region. At Bloemfontein and Potchefstroom the Directors of the Agricultural Colleges are the Directors of the Free State Region and High Veld Region respectively. The regions have Assistant Directors for both Research and Extension. A number of specialist Divisions of the Department also exist with headquarters in the Union Capital at Pretoria. Mr. M. S. du Toit, Director of Agricultural Technical Services has played a major part in developing the present organisation. I had the pleasure of an hour's discussion with him about the co-ordination of work within and between Regions and Specialist Divisions. The South African set-up may have lessons for Australia, but direct comparisons are not possible, for South Africa has Provinces with far less autonomy than the six Australian States, and it has only one Department of Agriculture for the Union. Though it has a Department of Scientific and Industrial Research, I understand that it is not in the field of agricultural research like the Australian C.S.I.R.O.

Agriculture in the Universities.

The linking of Department of Agriculture and the University Faculties of Agriculture appears likely to improve the facilities for research and for student training. There are over 200 students in Agriculture at each of the three Universities of Pretoria, Stellenbosch and Natal. (South Africa has several more Universities beside these.) At Pietermaritzburg the new Agriculture Building was nearly completed at the time of my visit. It was built by the Government at a cost of about £A400,000.

At Stellenbosch, I briefly discussed agricultural degree courses with Dr. Perold. The special course leading to a degree in Soil Conservation was discontinued in 1953. Students are now allowed a wide choice in the final year of the four-year course. Major courses in the fourth year are provided in Agronomy, Animal Husbandry, Dairying, Pomology, Viticulture Field Husbandry, Poultry Science, Agricultural Chemistry, Chemistry, Entomology, Plant Pathology, Microbiology Genetics and Agricultural Economics. A student, by selecting one or two of these and suitable lesser subjects thus completes his Degree course with some specialisation in the field of work he intends to enter.

Soil Conservation and Extension Work.

One of the Divisions of the Department of Agriculture is the Division of Soil Conservation and Extension. Its name might suggest that all agricultural extension officers are members of this Division, but in fact the field extension staff come under the control of the Regional Direc-

Fig. 4.—Erosion control near Ficksburg, Orange Free State. A dam has been made in one donga (gully), the second donga is the overflow. Contoured farmlands can also be seen.

tors and Assistant Directors (Extension). The Soil Conservation and Extension Division develops and controls through the Regions, the soil conservation and farm planning programme, but at the farmer level, the District Extension Officer advises on soil conservation as well as other farming matters. However the Soil Conservation Division also employs and directs its own specialist staff, including engineers, to design and carry out soil erosion control measures, especially on State works. State works are usually in areas where the severity of soil erosion has required State intervention.

Staff for Soil Conservation and Extension Work.

As indicated above, advice and action programmes in soil conservation at the farmer level are carried out by district extension officers as part of their general advisory duties. These officers are officers of the regions. The professional and technical staff establishment specifically associated with soil conservation **and extension** was given to me as follows:—(The figures include Divisional and Regional officers).

Director	1
Assistant Directors	10
Engineers (4 grades)	42
Professional Officers—	
Extension (4 grades)	202
Home Economics (Women)	37
Technical Assistants (3 grades)	288
Total	580

Many vacancies existed for extension officers and technical assistants in this establishment. In consequence many extension officers have much larger districts to handle than is considered desirable. I was further informed that to carry through the farm planning and associated subsidy programme it had been estimated that 300 Extension Officers (University graduates) and 1,000 technical assistants would be required. On several occasions I inquired about the number of farmers in the district embraced by one extension officer. At Kimberley, an extension officer had 1,500 farmers in his own area, but because of staff shortage, he was also embracing an adjacent area. At Bloemfontein an extension officer had 2,980 farmers (excluding small plot holders who reside on a small farm but work in a town). The district was 100 miles in diameter and there was a technical assistant. The two officers covered 19,000 miles per year by car.

In the High Veld region, the main food producing region of the Union, there are 28,000 farmers. The Assistant Director (Extension), Mr. P. C. de Villiers, said that his extension officers total 19, but vacancies exist and the present establishment provides for 25. According to districts and type of farming extension officers have now 1,000 to 2,500 farmers each. Technical assistants are attached to extension officers, to assist especially in the farm planning programme, with surveys and drafting and checking. Young men who have passed the Matriculation examination are preferred. They are given four months training course and six months practical farm experience. Only after two to three years experience do they undertake farm planning, under the direction of the extension officer.

It is expected, I understand, that approval will be given for the appointment of more extension officers and technical assistants, when they are available. South Africa, like Australia, has been unable to secure sufficient technical personnel for agricultural services, due to the great gap in recruitment and training in the depression, World War II and postwar, period, say 1931-1950.

SOUTH AFRICA

Showing Travel Route and Centres Visited

0 100 400 800

SCALE — MILES

PLATE 1.

It is of interest to note at this point that Southern Rhodesia, with only 5,000 European farmers, has 77 district conservation officers and 13 extension officers and vacancies for 12 more. Most of these are University graduates.

Women Advisers in Home Economics.

In 1953 the Union had 22 women employed as Home Economics Officers. The establishment provides for 37. I met two of these: Miss Hattingh at Potchefstroom, and Miss Moira Cilliers at Bethlehem. These officers have the University degree of B.Sc. (Domestic Science) and are paid the same salary as single men on the professional staff.* They work with agricultural clubs in the Land Service Movement (like our Junior Farmers), with branches of the Women's Agricultural Union (like our Country Women's Association), and with town groups. Miss Cilliers had a large territory, and travelled 6,000 miles per year by car.

Soil Erosion and its Control in South Africa.

Evidence of soil erosion is common in South Africa's farming and grazing lands,

*South African Government salaries seem to be based on equal pay for women and single men on comparable work. At the time of my visit married men were receiving £234 p.a. (South African) cost of living adjustment, single men about £50.

and in some cases the damage is severe. It is most spectacular on the waterways, and the worst I saw was in the Orange Free State areas north of Basutoland, and the Estcourt area of Natal.

We have often read of the severity of the problem in South Africa, yet I formed the impression after 3,000 miles of travel in the Union that we are too complacent in Australia if we think that erosion is a much smaller problem in this country. Perhaps unsuitable grazing and farming practices, and droughts, plus the defects of native agriculture, have caused South African to realise the need for its great conservation drive. Unlike Australia it has practically no unoccupied areas awaiting development.

Australians are familiar with the term "veld" but many, I think, believe it to be a particular area of open grazing country in South Africa. The term does apply to grazing country, but most of South Africa is natural grazing land, and the term veld is used much as the term "country" is used in Australia, with a preceding descriptive word. Thus in Australia we speak of forest country, scrub country, mulga country, saltbush country. In South Africa sweet veld is land on which the natural grasses are mostly palatable to stock; sour veld has unattractive grasses; mixed veld has some good and some poor grasses; bush veld has small trees with grass understorey rather like Australian mulga country; high veld is at high elevation; low veld is below 1,500 feet, which gives much hotter conditions in the latitudes of Transvaal.

It is convenient to mention here that natural forest is very restricted in South Africa and the growing of Australian Eucalypts for poles and posts, mine props and furniture wood is quite extensive. It is difficult for South Africans to conceive that Eucalypt trees have been destroyed on millions of acres of forests and woodlands in Australia to make farmlands.

In many parts of the Union, lack of suitable grazing control, along with droughts and veld burning, has caused widespread deterioration and accelerated water run-off, with consequent soil erosion in water courses and on slopes. Sloping

Fig. 5.—Basutoland is mountainous. This village is at 6,000ft. Contour ploughed lands can be seen on the right.

lands, ploughed for grain crops like maize and wheat, have water and wind erosion problems as in Australia. A great deal of the conservation efforts go therefore into the treatment of watercourses (dongas) to check soil losses, to conserve stock water, and to promote water absorption to improve water supplies at springs (fountains). The damming of watercourses with earth or concrete structures of various sizes is a major activity. Larger ones are carried out by the Soil Conservation Division as State works, smaller ones are built by farmers or contractors under the subsidy and farm plan arrangements.

Mechanical Works and Land Use Methods in Soil Conservation Programmes.

I formed the impression that South Africa had made originally what may be termed an engineering approach to soil conservation, but is giving much greater emphasis now to a biological approach. Besides approaching erosion control through concrete, masonry and earth structures in watercourses and on slopes, there is now much emphasis on maintaining surface cover to control the rainfall after it reaches the ground. The absorption of rain where it falls is a basic principle in soil conservation and erosion control programmes, and plant cover, either living or dead, plays a major role in achieving this aim. The biological or agronomic approach to soil conservation is now being strongly developed in South Africa, and receives due emphasis in the farm planning programme. The attitude to these matters is revealed by the following quotations from a recent review of soil

Fig. 6.—The Basuto natives have adopted contour ploughing on over 80 per cent. of their croplands. Contour lines are seen in this aerial view.

conservation in the Union by Dr. P. D. Henning, Director of Soil Conservation and Extension.*

> It is freely conceded today that the control of erosion and desiccation, as well as the promotion of better farming, are essentially biological problems, whose only real and final solution lies in the adoption of improved systems and methods of land use. Mechanical works (or **soil conservation works**) alone, can never solve these problems, and may indeed do more harm than good if attention is not given at the same time to the biological or land use aspects (or **soil conservation measures**). In the long run, therefore, far more importance attaches to measures than to works: yet they are mutually complementary and both are necessary facets of almost any soil conservation programme.
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> . . . . . .
>
> The farm plan is the high light of conservation activity in the field. It is the farmer's blueprint for the most efficient conduct of his farm operations in accordance with the principles of conservation farming; it prescribes specifically the most advantageous farming system to be adopted, the methods to be employed relating to veld management, crop rotation and the like, and also the various anti erosion and conservation works to be constructed on the particular farm.

Farm planning has not so far been adopted as the basis for soil conservation and erosion control programmes in Australia. Several States are, however, developing planning methods suited to their particular conditions, because it is well recognised that works and measures are best considered on the basis of whole farms or whole catchments.

As mentioned previously, some of the worst soil erosion has been in the eastern parts of the Orange Free State north of Basutoland. Here the soil conservation drive has been more intense than in most parts. About 30 per cent. of the crop lands in the eastern Free State are now worked on the contour between contour banks. This does not mean 30 per cent. of the total area of farms, because many farms include grazing areas which are never, or seldom cropped.

Finance for Soil Conservation.

The Division of Soil Conservation and Extension is one of the specialist Divisions of the Union Department of Agriculture. With its own staff and plant it constructs State works where erosion is severe. It also directs the farm planning and subsidy programme, though the detailed farm planning work is done by Extension officers of the eight Regions, in association with farmer-appointed District Committees.

The Soil Conservation Division controls earthmoving and associated plant to the value of £A1,250,000 for use on State works. This is operated by 372 foremen and mechanics besides native labour. For 1954-55 this Division had a Loan Vote of £A1,580,000 and a Revenue Vote of £A200,000.*

The Loan Vote was made up of:—

Soil Conservation Loans to Farmers	£A125,000
Bonuses and subsidies to farmers for Soil Conservation works	£A775,000
Reclamation and Conservation on State works	£A680,000
Total	£A1,580,000

Several points to be noted are:—

(a) Extension officers are on the regional staffs and are not a charge on the Division of Soil Conservation and Extension.

*Henning, P. D., "Progress of Soil Conservation in the Union of South Africa (excluding native areas) since the Inter-African Conference on Soils held at Goma in 1948", Paper presented to Inter-African Soil Conference, Belgian Congo, 1954.

*After deducting £A312,000 paid from Revenue to Loan Account.

Fig. 7.—A crop of blue-flowered lupins grown to harvest for seed on a dairying and wheat farm near Cape Town. There is much interest taken in lupins in these areas where they are grown for silage-making with oats and also for the seed as a high protein supplement in summer stock-feeding

(b) The direction of Agriculture and Soil Conservation on native lands and reserves is handled by separate staff and votes under the Ministry of Native Affairs.

(c) South Africa has about 118,000 European rural holdings with 200,000,000 acres of farming and grazing land.

Western Australia has 20,000 farmers and pastoralists with 35 million acres in farms and 180 million acres of pastoral leases. New South Wales has 73,000 rural holdings totalling 170,000,000 acres.

Subsidies for Soil Conservation and Water Conservation Works.

Cash subsidies are paid to farmers in South Africa for a wide variety of approved soil and water conservation works and £A775,000 was provided for this in the 1954-55 Budget. Southern and Northern Rhodesia have somewhat similar subsidies and so does the United States of America.* No Australian State uses this system of encouraging soil conservation, but expenditures by farmers on certain soil conservation works are allowable deductions before assessing income tax. In South Africa, contour earthworks, dams, concrete and masonry structures, fences and silos are subsidised about one third of their cost as assessed in standard tariffs. These works must, however, be part of an approved farm plan drawn up by a district committee and soil conservation officer (usually the district extension officer).

Farm Planning is the Basis for Subsidies.

Seventy two per cent. of South Africa's farmlands, excluding native areas, is now included in 524 proclaimed Soil Conservation Districts. An elected Soil Conservation District Committee manages the affairs of the district and is responsible for seeing that detailed farm plans are prepared for all farms in the district. These farm plans are the basis for subsidy payments. They have considerable detail, including farming and grazing practices, as well as farm design. Once drawn up, approved, accepted, and signed by the farmer, the plan is binding on the farmer.

The preparation of farm plans for most of the Union's farms is obviously a major task, and occupies much of the time of district extension officers. It has been estimated, as stated earlier, that 300 Extension officers (University graduates in Agriculture) and 1,000 technical assistants will be necessary for the farm planning programme, as well as for general advisory duties.

*See Herriot, R. I., "Soil Conservation in the United States" Jour. of Agric., South Australia, Vol. 55, pp. 204 and 246, 1951-52.

Fig. 8.—Contour banked area and waterways, Tygerberg Soil Conservation Area near Capetown. The flowers are capeweed *(gousblom)*. Cape tulip *(Homeria sp.)* and doublegee *(Emex australis)* were also seen in these parts.

The farm planning and subsidy approach to soil conservation with the element of compulsion included in the farm planning documents, was of special interest, because nowhere in Australia is such a system used. Whenever possible I discussed the scheme with district extension officers and a few farmers. Farmers were evidently pleased with it, but I could not help feeling that district extension officers and their technical assistants had a heavy burden in the pressure for plans, and also in checking the sizes of dams or earthworks, lengths and type of fences, nature and volume of concrete and masonry and such like, so that subsidies according to standard tariffs could be recommended.

From a national standpoint the encouragement of soil conservation and soil erosion control is most essential. It should be encouraged by adequate research and advisory services and technical assistance to farmers, and perhaps by limited direct expenditure of public funds in special cases. Farmers must be encouraged to see that they, and their attitudes, are the keys to effective soil conservation. A system of taxation rebates for expenditure on certain soil conservation practices, as applied in Australia, gives of course, the biggest rebates to those with the biggest incomes. In the present state of the Australian agricultural economy, a system of subsidies as used in South Africa—and the Rhodesias—does not appeal as an improvement The South African system of districts and subsidies has been patterned on U.S.A. Soil scientists from U.S.A., whom I met in Belgian Congo, told me that a move had been made to halve the large subsidy payments in their country, but political pressures in Congress had prevented any major reduction.

BASUTOLAND

Before discussing other aspects of South African agriculture it is appropriate to describe Basutoland, the native territory administered by the British Colonial Service, and lying between Natal and the Orange Free State (See map Plate 1.)

Basutoland embraces about 12,000 square miles of mountainous country whose streams drain west to form the Orange River and its tributaries.

Elevations range from 4,000 to 11,000 feet, the highest parts being along the eastern border where the ridge of the Drakensberg marks the Basutoland-Natal border. Europeans number about 1,700. The 700,000 natives grow maize (mealies) at the lower elevations, and wheat and beans above 6,000 feet. 1,300,000 sheep return an average of £2 per head for wool and mohair. There are 550,000 goats as well as 400,000 cattle, which are a measure of wealth with native peoples.

The farming and grazing practices of the natives have caused some spectacular gully erosion in the past 100 years, but the British Colonial Service officers have done excellent work in encouraging and assisting the natives (through their chiefs) with erosion control. Contour banks and contour grass strips have been intensively applied. Grazing is controlled even though there are no fences. Burning the grasslands is discouraged. Poplars are planted at the heads of erosion gullies on mountain slopes.

Mr. L. H. Collett, M.B.E., Soil Conservation Officer, has been working on this programme since 1936, but is soon to retire. His influence, and the support of the British Colonial administrators, are reflected in the following figures:—

	Acres,
Area of land suitable for ploughing	1,000,000
Area of land ploughed on the contour	850,000
	Miles.
Contour banks	19,000
Contour grass strips	30,000

Such an intensity of use of contour practices must surely not be exceeded in any other country. The Colonial Development and Welfare Fund has provided about £A500,000 in the past ten years for earthmoving plant to assist the conservation programme.

OTHER ASPECTS OF SOUTH AFRICAN AGRICULTURE

1.—Lupins and Subterranean Clover in the Winter Rainfall Region.

My time in the winter rainfall areas around Cape Town and Stellenbosch was all too brief. The climate here is so similar to the agricultural areas of Western Australia that my interests in similarities and differences of the two areas was naturally very keen.

Cape Town was established in 1653 by Jan van Riebeck, so that farming has been going in for a much longer time around the Cape than in Western Australia. In view of the interest in Western Australia about nitrogen status and soil fertility in wheat growing areas, it was interesting to see, and hear about, the great interest in subterranean clover and lupins in the cereal growing and mixed farming areas of the Cape. It was also of interest in this connection to hear that wheat is usually planted with mixed fertiliser, including nitrogen and phosphate.

The mixed farming of these parts often includes dairying with cereal growing, and silage is much used. Lupins are grown with oats for silage, but also for seed to feed in summer as a protein concentrate. Lupin selection work at Stellenbosch-Elsenburg College of Agriculture has been directed towards sweet, non-shattering varieties with a low percentage of hard seeds. This would serve well to plant as an annual crop for silage or seed stripping. I described how our Western Australian blue lupin is bitter, shatters and scatters its seeds, and has a high percentage of hard seeds; all desirable characteristics as the lupin is usually used in Western Australia, for summer and autumn grazing of sheep on the naturally scattered seeds. Some South African sheep farmers are interested in such characteristics, I was told. I saw blue flowered lupins rather like New Zealand blue lupins, and also a shorter yellow-flowered variety (S.E.1).

Fig. 9.—Oranges packed for market in orange coloured string pockets, Zebedella Citrus Estates, Transvaal, the largest citrus estate in the world—5,800 acres of trees, all irrigated.

Subterranean clover, especially the Dwalganup strain, has been planted quite extensively in recent years in 15-20 inch rainfall areas especially around Caledon and Bredarsdorp (which I had to omit owing to minor illness after leaving Belgian Congo.) At Stellenbosch-Elsenberg College, 30 miles from Cape Town, Professor J. T. Sim also showed me Yarloop (white-seeded) sub clover, which the South Africans say is more resistant to sand mite (red legged earth mite, *Halotydaeus destructor*) than Dwalganup and other strains. The ability of the white-seeded strain to grow under waterlogged and surface flooded conditions, was not known to Professor Sim.

Lucerne has been much used in the past, even though heavy applications of lime were necessary for successful growth. I saw a good stand on soil with dense ironstone gravel in the subsoil; a pit about 4ft. deep for road gravel was adjacent. Arabian lucerne is doing well. Besides work on lupins and sub. clover other promising species at Stellenbosch for winter-rainfall conditions are:—

Kentucky 31 fescue—very palatable.

Cocksfoot — Aberystwyth Hay Strain S/37.

Eragrostis curvula, Eragrostis chloromelas—Natural grasses of South Africa.

Neither *Hyparrhenia hirta* (thatch grass) nor perennial veldt grass (*Ehrharta*

Fig. 10.—The latest three-room living quarters for married native employees, Zebedelia Citrus Estates, Transvaal. They are built of mud and decorated and thatched by natives. Cash outlay about £40.

calycina) has been considered worthy of cultivation. Both are being investigated in Western Australia as perennial species.

The Cape was visited in September, and with Cape weed (gousblom, *Cryptostemma calendulaceum*) Cape tulip (*Homeria* sp.) and doublegee *(Emex australis)* all prominent, our links with this area were all too evident. Perennial veldt grass (*Ehrharta calycina*) was seen by the roadsides. The Cape, like Western Australia, is noted for some attractive wildflowers, some of which were seen and admired.

2.—Soil Salinity.

Little evidence of salt (brak in South Africa) was seen on farmlands. I was told that at Malmesbury, north of Cape Town, with a rainfall of about 15 inches, winter type, some depressions are salt-affected and become bare. Dams in depressions are avoided because of this, and it seems that it could be a similar problem to that in similar rainfall in Western Australia.

The topography and geology of the areas north and east of Cape Town is quite different from the agricultural areas of Western Australia. The Cape area is hilly and there are mountains 2,000-5,000ft. high 30 to 50 miles inland. The tops still carried snow in mid-September. Sandstones and shales are the principal rocks, though granite occurs in parts, as at Paarl, an important vine growing area, named after the large pearl-shaped granite mountain nearby.

I enquired about *Paspalum vaginatum* (sea shore Paspalum) a summer-growing, salt-tolerant grass used in Western Australia, but those agricultural officers I met did not know it. This grass is said to have been brought to South Australia (and thence to Western Australia) from the Millertown Race Course not far from Cape Town. Here, according to reports, it is watered with sea water.

In some irrigation areas, e.g. Worcester, salt was seen at the roadsides. On irrigation lands, grading, drainage and use of barley as a first crop, evidently gives satisfactory control. East of Bloemfontein, and also south of Senekal in the Orange Free State, I saw brak areas which had been treated with some type of ripper or subsoiler. On a sloping site the work was done on the contour. In both cases examination of the soil showed a dense sealed layer of half to one inch on the surface, with better structure beneath. It seemed the typical surface seal which develops when sodium reaches 15 to 20 per cent. of the exchangeable metal cations in the

soil. The ripping was intended to give better water penetration and promote grass growth. I could get no clear evidence about the most desirable depth of ripping. Rather it seemed that a ripper or subsoiler had been used to roughen the soil and burst the surface seal, a job not possible with lighter implements.

At Potchefstroom Agricultural College, in the High Veld Region, brak sometimes occurs on the heavy clay "turf" soils. The growth of feed mangels is recommended in such cases.

Fig. 11.—Afrikaner bull, Glen Agricultural College, Bloemfontein. This breed tolerates extremes of heat and cold, and may be useful in northern Australia.

3.—Trace Elements for Animals and Plants.

Coast disease, due to deficiencies of copper and cobalt, affects stock grazing on the coastal areas around the Cape. The administration of copper and cobalt through the drinking water will be made much easier by using new compounds developed by Dr. Perold at Stellenbosch. Copper and cobalt in these compounds will remain in solution in strongly alkaline and saline waters. It was hoped by Dr. Perold that the cost of the compounds would be less than £A1 10s. for 1,000 sheep per month.

At George, on the south coast, about 250 miles east of Cape Town is a coastal plain with low scrub, generally similar to the country in the vicinity of Esperance on the south coast of Western Australia. The soils, have grey to grey-brown sandy surface (pH 5.5 to 6.2) there is ironstone gravel below a foot, and yellow and grey brown clay at about two feet. The underlying rock is said to be granite, but some of the surface fine sand may be derived from the adjacent sandstone mountains. The rainfall is 32 inches with peaks in February-March, and September to November. The winter rainfall of the Cape is giving way to the summer rainfall of the country farther east.

On a typical area of this plain the Outeniqua Experiment Station was started a few years ago at the direction of the South African Minister for Agriculture. He had visited Australia and seen the impressive work with fertilisers and trace elements on poor sandy soils. Work is going on with cereals and pastures and various fertilisers. Phosphate deficiency is acute. Superphosphate at 3 cwt. per acre on new land seemed to give little residual effect for ladino clover the following year. Langphos, a South African phosphate rock, gave a good residual effect.

Work with trace elements included manganese and copper, but zinc had not been tried. From my experience in Western Australia I was able to point out during a short visit, that plots of Bacchus Marsh (?) and Yarloop subterranean clover were showing very definite symptoms of zinc deficiency. Oats showed the dark grey to almost black lower leaves which we know as a field symptom of zinc deficiency. A linseed crop a few inches high seemed to be just recovering from dieback, and again zinc deficiency suggested itself. It is interesting to note, however, that ladino clover was doing well. It may have a lower zinc requirement than sub-clover. Dark leaves on growing oats, and dark straw when mature, were said to have been noted by farmers already farming some parts of this coastal plain. The similarity to Esperance was most remarkable.

4.—Fruit Growing.

South Africa produces large quantities of fruit, for home use and export as fresh fruit, wine and canned fruit. (see Table I for comparisons with Australia.) I saw practically nothing of the pineapple and banana areas, but these were visited by

Fig. 12.—Ostriches and "Friesland" cattle on lucerne pasture Oudtshoorn, Little Karoo.

Dr. C. G. Stephens of C.S.I.R.O. Division of Soils, who was in South Africa at the same time.

Near Stellenbosch in the Winter Rainfall Region, the Western Province Fruit Research Station has an experimental orchard at Bien Donne where climatic conditions are almost identical with those in some of the winter rainfall fruit growing areas of Western Australia.* Here, during a short visit, I saw a variety of work on peaches, pears, apples, olives, guavas, avocadoes and pecans.

On Elberta peaches 2 per cent. Dytrol spray had been applied on July 22, in experiments to control irregular flowering and foliation. Good results were expected. Similar trials on the same problem are under way in Western Australia. The peach variety Bourland, selected at Stellenbosch, is a high-yielding, white-fleshed, mid-season freestone variety, and shows little tendency to delayed or irregular foliation.

Lupin green manure crops were at full growth and in flower during my mid-September visit to Bien Donne. I was told that unless the cover crop is very heavy, sulphate of ammonia up to 500 lb. per acre is used to ensure sufficient nitrogen for peaches.

The annual field day at Bien Donne now attracts about 1,500 visitors.

*de Villiers, G. D. B.—A Ten Year Summary of the Climatological Data Recorded at the Agro-meteorological Observatory, Groot Drakenstein, 1941-1950. South Africa Department of Agriculture Science Bulletin 349, 1954.

In the Little Karoo, where the rainfall is only 7 to 12 inches, I was surprised to find much fruit-growing using irrigation water from snow-fed streams. Both north and south, mountains rise 3,000 to 5,000 feet. Vines for wine and some for dried vine fruits, and peaches for canning, are the most important fruits. The Kakomas variety of peach is favoured in these areas.

Citrus fruits in South Africa double Australia's production. Near Pietersburg in Transvaal I visited the Zebedelia Citrus Estates, said to be the largest in the world. Here are 5,800 acres of citrus, mostly oranges, irrigated from dams and bores. Each tree grows near the centre of four earth basins, and according to the supplies of water available, water is let into one or more of the basins. All weeding and cultivation are done by hand, by the staff of 3,000 mainly native men and women. The 480,000 trees produce as much as 1,500,000 bushels of fruit a year. Narrow-gauge railways run out several miles from the large packing shed, where the fruit is washed and dried before packing into large string pockets for the home market or into cases for export.

Fruit fly is now controlled at Zebedelia by the use of parathion sprays. Sulphur dusting is done by aeroplane.

The newest three roomed dwellings for for married native employees attracted my attention. They are built and decorated by the natives from mud and local thatch grass and timber. The cost to the company is about £40 per house.

5.—Irrigation.

Irrigation to supplement the rainfall and to allow intense production in low rainfall parts is very common on South African farms. Some areas are served from large dams, others depend on individual bores or dams. Irrigation of fruit and lucerne in the Little Karoo has been mentioned. Flying over the Great Karoo green irrigated lucerne patches could be seen near the homesteads of the sheep farms.

South of Kimberley, where there is an 18 inch summer rainfall, I passed through the Riet River Irrigation Area where lucerne and wheat are grown. At the Reit River Research Station, seed potatoes of the variety Up-to-Date are produced, free

SOUTH AFRICA

Showing Regions for Operations and Administration of the Department of Agriculture

PLATE 2.

of virus X, a virus which lowers potato yields considerably and yet some strains give no visible evidence of presence in the crop.

North of Kimberley, near Warrenton, is the Vaal Hartz Irrigation Area. Water from the Vaal River is taken into the dry Hartz valley to irrigate about 180,000 acres of red sandy soil. Wheat, lucerne and peanuts are grown. The Vaal Hartz Research Station which I visited, also does work on cattle, poultry, vines and pastures. Here I was told of a proposal to sterilise, flavour and bottle skim milk to sell to natives working on the mines instead of aerated waters. The net return to the dairy farmers was expected to exceed that paid by cheese factories.

The siltation of reservoirs is a problem intimately related to the problem of soil erosion. In the vicinity of Cradock in the eastern Cape Province the Lake Arthur dam has been reduced in capacity by siltation from 87,000 acre feet to 27,000 acre feet in 25 years. The Grass Ridge Dam on the Fish River is silting up at the rate of 1,100 acre feet a year as the incoming water has 3½ per cent. of silt. Soil conservation work on the catchment is directed to reducing these siltation rates.

Winter irrigated pastures to provide green grazing in the dry winter period are being investigated at Glen Agricultural College at Bloemfontein. In the Transvaal and in Southern Rhodesia there is similar work in progress. All these areas have some severe winter frosts. The mixtures under trial are:—

Glen Agricultural College (J. W. C. Mostert.) Chilean red clover, N.Z. wild white clover. Kentucky 31 fescue, Italian ryegrass.

Clovers tend to dominate and new trials will include higher proportions of grasses in seed mixtures (15 lb. grass, 3 lb. clover per acre).

Transvaal (Mr. Bekker, Extension Officer.) Giant red clover. N.Z. wild white clover, ladino clover and berseem clover. Tall fescue, *Phalaris tuberosa* and Italian ryegrass. Cocksfoot as an alternative to *Phalaris tuberosa*.

Southern Rhodesia (Dr. O. West, Grasslands Research Station, Marandellas). Red clover and subterranean clover (variety uncertain) Kentucky 31 fescue, Alta fescue, Italian rye, Cocksfoot, *Phalaris tuberosa* and *Phalaris arundinacea*.

6.—Location of Underground Water.

Considerable use is made in South Africa of electrical methods to determine likely places where underground water can accumulate in more weathered zones of the underlying rock. The work is performed by officers of the Geological Survey with whose Director I had a short discussion. Since returning to Australia I have been supplied with much more complete data.

Government boring plants operate as far as possible only on sites determined by the geologists. The methods are particularly applied in granite country.

7.—Animal Husbandry—Cattle, Sheep and Ostriches.

Cattle, both beef and dairy, and sheep for wool and meat are of major importance in South Africa's agriculture. Afrikaner cattle were shown to me on several occasions. This breed with its long horns and slight shoulder hump tolerates extremes of heat and cold very well. Some South Africans expressed surprise that Australia did not show more interest in this breed for north Australia.*

The Friesian breed (always called Friesland, in South Africa) is evidently much favoured for dairying, although other breeds were also seen.

At University of Pretoria, Dr. Starke is working on the development of more suitable meat sheep for hot summer rainfall conditions by crossing and selection from the short-woolled, black-faced Persian sheep, and the Dorset Horn. The result is called a Dorper. The same cross is being worked on in Southern Rhodesia, where German Merino blood is also included. Southdowns waste away in the Pretoria environment.

In the eastern Cape area at Cradock the Dorset Horn X German Merino, called Dormers, were seen. This cross evidently gives large lambs.

No mention of animal industry would be complete without references to ostriches. At Oudtshoorn in the Little Karoo, ostriches are again profitably farmed for feathers, meat and fine leather production. I saw large numbers, some grazing with cattle on lucerne pastures. A good ostrich about 18 months old is valued at about £10.

8.—Farm Labour.

The labour situation on African farms is quite different from Australia. Large numbers of natives live and work on farms and are paid wages and rations which make labour appear very cheap by Australian standards. £4 to £6 per month plus rations seemed a common figure. The natives usually construct their own houses. I was often told, however, that native labour was rather inefficient. With most of the less skilled work in their country done by natives, South Africans find it hard to conceive that all our farm work, coal mining, gold mining, railway maintenance work etc., is carried out by white people at wage rates of £A13 per week and more.

Hand milking, silage making, carting and spreading animal manure, harvesting

*I understand some Afrikaner cattle have been taken to New Guinea as well as Zebu types. Quarantine regulations do not allow imports of cattle from Africa to Australia.

and thrashing maize and peanuts, shepherding cattle and sheep, tobacco growing, pineapple production, fruit picking and canning, tending wattle plantations, and so on are tasks where native labour can be used to advantage under present conditions.

In some cases properties are referred to as labour farms. They belong to European farmers who allow natives to live on them and grow their food crops and run stock. In return the natives must work at various seasons, and as required, on the farm of the European owner. Some labour farms are badly affected by soil erosion because of their poor handling by the native occupiers.

(To be continued.)

FARMERS

This is YOUR Journal, and it has been written, edited and presented in a sincere endeavour to give you helpful information in an interesting manner.

We would like to have your views on the Journal—to know whether you like it or whether you don't. Drop a line to the editor and tell him the features you like and don't like in this issue—or the features you hope to see in future issues.

MURESK AGRICULTURAL COLLEGE

(Department of Agriculture)

Parents are reminded that applications for 1958 admission to Muresk Agricultural College close on 31st December of this year. A preliminary selection of 1958 entrants is made after the Junior results are available in January, 1957.

The successful applicants then continue with Sub-Leaving studies during 1957.

The Entrance qualifications include:—

(a) Sub-Leaving English, Mathematics A, Physics (including Magnetism and Electricity), and Chemistry.

(b) Junior Bookkeeping.

Should places still exist after the preliminary selection qualified applicants are enrolled in the order of application.

A few vacancies exist for 1957 admission, for those who will possess the above qualifications before the re-commencement of the College year on Saturday, 16th February, 1957.

DURATION OF COURSE—Two years.

FEES—Approximately £100 per annum covering full residential charges.

SCHOLARSHIPS—Department of Agriculture, the "Countryman," and J. J. Poynton Memorial Scholarship.

BOARDING ALLOWANCE—Most Muresk students are eligible for the Education Department Boarding Allowance (£50 per annum).

Full details of the College are obtainable from the Principal, Muresk Agricultural College, Muresk, W.A., or the Department of Agriculture, Perth.

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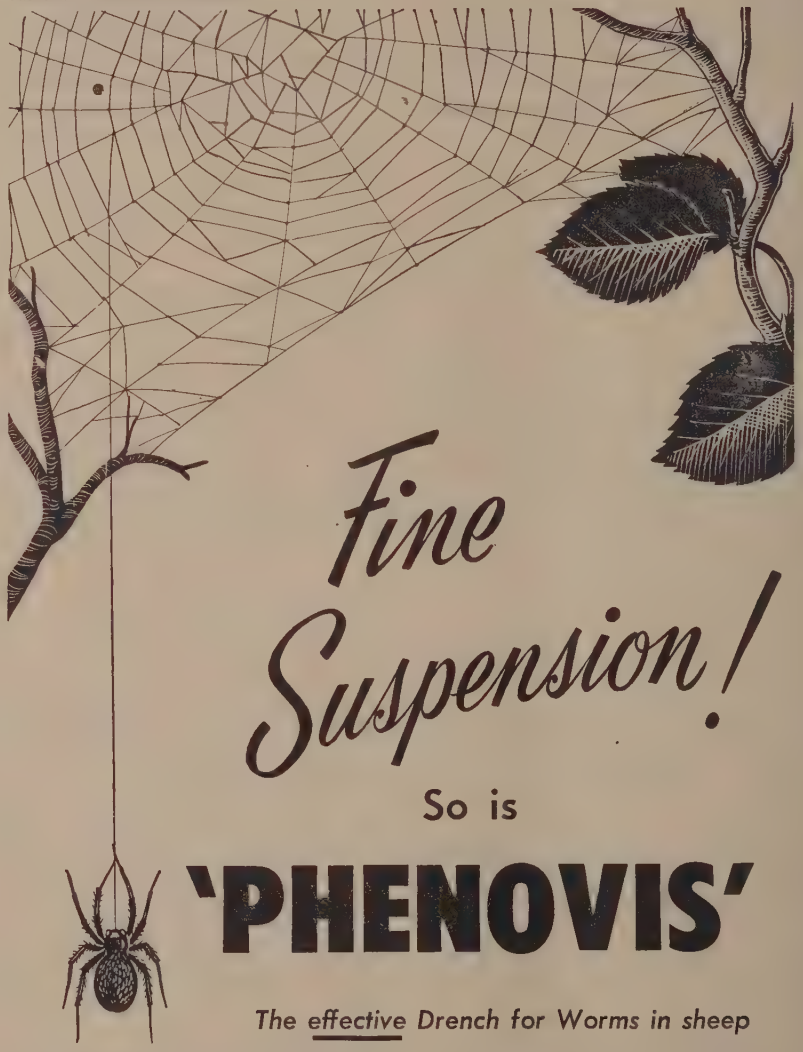

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Oats and Vetches for Hay and Silage

By F. E. RYAN
Agrostologist

OATEN hay, or oats conserved in the form of silage, is always a valuable insurance against lean periods on the dairy farm—but if that hay or silage is made from a mixture of oats and vetches, it will be infinitely more valuable. The vetches give a much greater bulk of feed and, being legumes, they boost the protein content of the fodder, so that it cuts down the need for costly supplementary feeding.

The Dairying Division of the Department of Agriculture has carried out a lot of experimental work in recent years to determine the best types of vetches and oats to use, and the best methods of producing the crops.

The most satisfactory mixture used in the experiments so far has been 15 lb. of Commercial Purple vetch seed sown with 60 lb. of Algerian oats per acre, using 2 cwt. of superphosphate or a similar quantity of super-copper-zinc if the land is copper or zinc deficient.

A bulky crop of oats and vetches grown at Armadale

On potash deficient areas, good crops cannot be expected unless the deficiency is rectified by the application of 1 cwt. of muriate of potash to the acre.

TYPE OF VETCHES TO SOW

Common vetches (Golden Tares), Commercial Purple, several introduced strains of purple vetch and common vetch and one flowered vetch (*Vicia articulata*) were among the varieties tested.

Commercial Purple was outstanding in the dairying districts although *Vicia articulata* gave good results in the drier districts such as Boyup Brook and Darkan.

Vetches are weak-stemmed plants which lodge quickly if grown alone. A cereal crop provides support for the vetches, and oats are the most satisfactory crop for this purpose.

TYPE OF OATS TO SOW

In selecting an oat variety to combine with the vetches, it was necessary to take into consideration the differences in growth habits of the two plants. In our trials, the vetches grew slowly during autumn and winter and made rapid progress in spring. Oats which made vigorous autumn and early winter growth were apt to "smother" the vetches.

Algerian oats are the recommended variety, as their growth habits most closely approximate those of the vetches.

SEEDING RATES

The experiments showed how important it is to maintain a good balance of the species. If the vetches are sown too thickly, they tend to choke out the oats in early part of the season.

If too heavy a seeding of oats is made, they will dominate the stand and the vetches will be too thin.

We tried various sowing rates, using up to 60 lb. of vetches to the acre without obtaining any increase in the total quantity of hay or the proportion of vetches to oats.

We recommend 15 lb. of Commercial Purple vetch and 60 lb. Algerian oats for most sowings.

In the early stages of the experimental work, vetch seed was difficult to obtain and supplies were imported from Tasmania, the Eastern States and the U.S.A.

Since then, seed production of the Commercial Purple vetch has increased in Western Australia and there should be no difficulty in obtaining seed locally.

TIME OF PLANTING

Oat and vetch crops are best sown in the late autumn and most crops are not planted till the end of May or the beginning of June. This has been found to be a suitable time, as earlier sowings have resulted in more rapid growth of oats with a consequent reduction in the contribution from the vetches. For this reason, early autumn planting is not favoured for crops of oats and vetches. As these crops fit into a rotation, and weed control should be carried out during the cultivation year, the later planting provides an excellent opportunity for controlling weeds by autumn cultivation.

GRAZING

The vetch and oat mixture may be grazed during the winter and early spring. This has been found helpful in preserving a balance of plants when the oats have grown too rapidly for the vetches in the early stages. It may also be necessary to adopt such a practice if an earlier variety of oats such as Ballidu is used instead of Algerian. Grazing has been successfully carried out on oat and vetch crops as late as September, but the aim should be to cease grazing after the end of August.

When the oat and vetch crop is grazed, stock show a preference for the oats and these are reduced in height to give the vetches a better opportunity of making strong development. Quick grazing, preferably by means of strips, using an electric fence is suggested, but the oat and vetch mixture should not be grazed too close to the ground before the stock are removed.

DEMONSTRATIONS WITH VETCHES AND OATS

During the last five years, 34 demonstrations have been carried out with vetches and oats in dairying areas. Almost without exception, these demonstrations have proved very successful, although in one or two instances a low proportion of vetches has resulted from very wet conditions during the year.

Yields of up to 3½ tons per acre of hay have been obtained and when fed to stock these have given good results. The demonstrations have convinced many farmers of the value of this crop and the area being planted to vetches and oats is increasing each year. The increase has been quite rapid and the demand for seed has frequently exceeded available supplies.

TIME OF CUTTING

Vetches make very strong growth at the end of the growing period in the spring, and frequently they are still making vigorous growth when the oats have reached the "milky" or "dough" stage when they are normally cut for hay. In many crops the vetches have provided the main bulk of the hay and, where this is the case, cutting for hay should be determined by the stage of growth of the vetches rather than the oats. Vetches should be cut for hay when the pods are beginning to swell. Flowering in the vetches is rather prolonged, especially in purple vetches and the time of cutting should be determined from the swelling of the earliest-formed pods.

When the vetches have reached this stage, the oats may be more advanced than is usually the case, but as the vetches

are providing the bulk of the crop, the oats serve firstly to hold up the vetches and secondly to provide some oaten grain among the hay. The nutritive value of hay made from oats and vetches and cut at this stage, is still high, and protein content in the dry matter of the hay ranges from 12 per cent. to 19 per cent. protein, which is at least twice the content of protein that would be expected in the average oaten hay crop.

FERTILISER

In all trials and demonstrations, superphosphate at the rate of 2 cwt. per acre has been used and this rate of application appears to be quite satisfactory for this crop. Where copper, zinc or potash deficiencies are likely to be encountered, these should be rectified if a good crop is to be expected.

PLACE IN ROTATION

On many farms, subterranean clover pastures deteriorate after a period of eight to ten years, and weed species such as silvergrass, capeweed, flatweed, etc., occupy a large proportion of the pasture area. At this stage it is recommended that the pasture should be ploughed up and weed control attempted before improved pasture species are sown back into the paddock. After ploughing, a number of cultivations may be necessary before weeds are suppressed and this results in a considerable delay in sowing back to pasture. An oat crop or an oat and vetch crop has been used during this cultivation year. The early autumn cultivations for weed control may be carried out and the rather late autumn or early winter planting of vetches and oats is found quite satisfactory. The tall-growing crop of vetches and oats also acts as a cleaning crop to keep in control and prevent the seeding of weed species which may still be present in the paddock.

By growing a crop of oats and vetches during the cultivation year, the paddock is not idle and a heavy yield of good quality hay is provided while the weed control programme is in progress. In the following autumn the land is ready for early cultivation for seed bed preparation and with only a minimum of weed control can be planted with improved pasture species.

WET SITUATIONS

Vetches have not proved very suitable for wet situations. During the last two years, wet conditions in the early spring in 1955 and the winter of 1956, have resulted in poor stands in low-lying paddocks. Under these conditions the nodulation of the vetches is defective, even though they have been treated with inoculant, and plants become very spindly, taking on a reddish-purple colour. Such plants do not succeed in making strong growth in the spring. For this reason vetches and oats should not be sown on paddocks which are liable to become excessively wet during the winter months.

SUMMARY

Commercial Purple vetch and Algerian oats are sown at rates of 15 lb. and 60 lb. per acre respectively. They are fertilised with superphosphate at 2 cwts. per acre. Wet paddocks or those which become waterlogged in winter time are unsuitable. Sowing of this crop may be delayed until the end of May or the beginning of June to enable autumn cultivation for weed control. Where oats are growing too rapidly for the vetches, during the autumn and winter months a better balance of species may be obtained by grazing.

The crop is cut for hay when the pods begin to swell and for silage when the first pods are first formed. Vetches and oats fit very well into a rotational system on dairy farms and assist with the introduction of more improved grass and legume species.

THIS WEED LIVES UP TO ITS NAME

If ever there's a well-named weed it's Stinkwort.

Look at a Stinkwort flower under a magnifying glass and you'll find its petals covered with fine hairs, barbed and feathered like an arrow.

These find their mark in the stomach and intestines of livestock. Fatal diseases, such as Pulpy Kidney in sheep, set in; death sometimes occurs without any apparent cause. Even if the weed does not kill stock, it taints milk, cream and meat.

Several control measures have been tried for Stinkwort. Scientists have found that it shrivels under a hormone spray weedkiller* supplied by Shell. This weedicide kills the Stinkwort, but when used correctly does not harm established grasses, crops or livestock.

Again SHELL products are helping the man on the land in his fight against weed pests which affect stock and crops.

*Shell Weedkiller E

339/D

ST. JOHN'S WORT

(*Hypericum perforatum* L. var. *angustifolium* D.C.)

St. John's Wort, a common European plant, was with little doubt introduced from Victoria along with hay during the early timber milling days. It has been found at many old campsites in the timber country. Besides being a vigorous perennial weed, St. John's Wort is also poisonous to animals.

WEEDS of Western Australia

By **G.R.W. MEADLY** M. Sc.
Officer in Charge, Weeds and Seeds Branch

ST. JOHN'S WORT

(Hypericum perforatum L. var angustifolium D.C.)

ST. JOHN'S wort is native to the temperate regions of Europe and Asia, but as with many other of our weeds, appears to have little significance in its natural habitat. In countries of its adoption, however, the story is very different. For example, in Canada and America it occurs over extensive areas of range land while in Australia it is proving a very serious weed.

The main centres of infestation in this country are the hillsides and elevated valleys of north-eastern Victoria, the high rainfall area of the Southern tablelands of New South Wales and also the Mudgee, Rylestone and Wallerawang districts of the Central tablelands of that State. It occurs to a limited extent on the Mt. Lofty Ranges in South Australia and has been located in a number of districts in this State. Moore and Cashmore (1942) record that, in general, the most severe wort infestations occur at elevations of almost 2,000ft.; having an annual rainfall exceeding 30 inches with a winter peak but otherwise evenly distributed throughout the year.

St. John's wort has been known in Victoria and New South Wales since the latter part of last century having been introduced as a garden plant about 1880. At first the weed showed little tendency to spread, but subsequently in a period of a few years, occupied extensive areas.

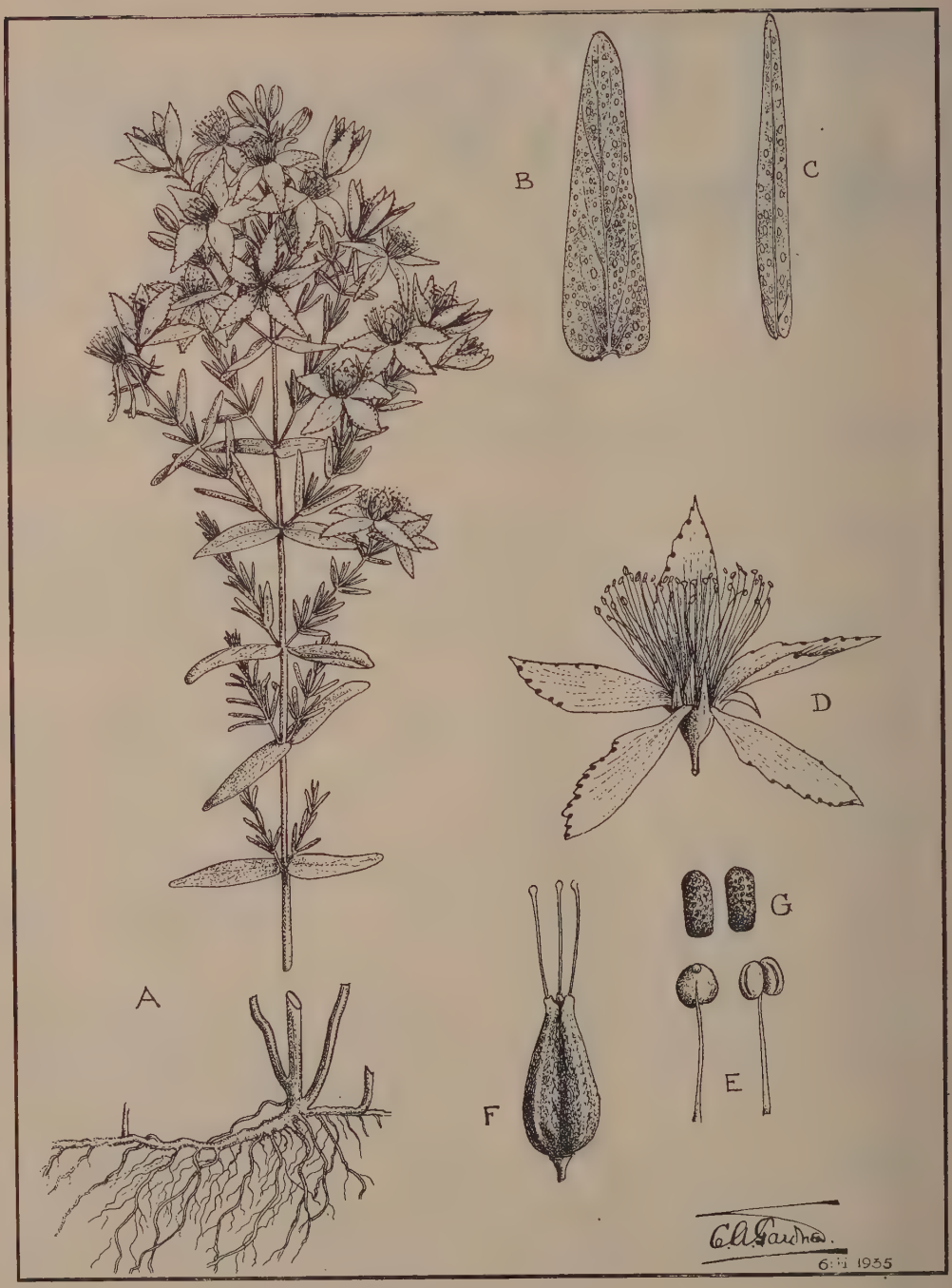
Some impression of the rapid spread in Victoria can be gained from the following figures presented by Calvert (1932)—

Areas of Infestation in Victoria at Different Periods.

Year.	Crown Land.	Private Property.	Total.
	acres.	acres.	acres.
1880	....	1	1
1902	2,910	5,639	8,549
1905	4,000	6,210	10,210
1916	156,000	28,000	184,000
1931	....	....	244,519

A similar pattern of rapid spread after a quiescent period has been followed by many weeds in other countries as well as Australia. Mesquite in the North-West of this State is a further spectacular example.

The first record in Western Australia was in 1934 when plants were found in the Margaret River, Augusta and Karridale areas. It has since been recorded from Arumvale, Pinjarra, Holyoake, Mornington, Greenbushes, Nannup and Capel. There is little doubt that many of the occurrences are associated with the importation of chaff from affected areas in the other States and the weed provides a link with the early timber felling and milling



ST. JOHN'S WORT.

(Hypericum perforatum var. *angustifolium.)*

A—Showing habit; B and C—Leaves; D—Flower; E—Stamens; F—Fruit; G—Seeds.

days. The nucleus of an infestation is often a horse-yard or paddock at an old mill camp.

DESCRIPTION

The name St. John's wort is no doubt a modification of St. John's blood which refers to the pigment derived from the petals. In America and Canada it is known as Klamath weed while other common names include Witch's herb and Racecourse weed.

It is a glabrous perennial with erect stems, sometimes exceeding three feet in height and arising from a creeping root system. The narrow leaves, up to one inch long, arise opposite one another on the stems and are sprinkled with conspicuous oil glands which give a perforated appearance when held to the light. The showy yellow flowers each having five petals are formed in leafy panicles at the ends of the branches. The fruit is a sticky three valved capsule containing numerous minutely pitted cylindrical seeds, brown in colour. The plants are relatively dormant during the winter period but make rapid growth during the spring and early summer. Flowering usually extends from November to February and seeds are produced from mid summer onwards. Although a limited amount of spread occurs from the rhizomes, particularly when carried by cultivating implements, seeds are responsible for the main distribution.

SIGNIFICANCE

Agricultural scientists in California have pointed out that St. John's wort, by poisoning live stock and reducing fodder, is the greatest single cause of financial losses on range and pasture in that State. The replacement of useful grazing species by this weed can cause a big reduction in carrying capacity, while its toxic properties are an important aspect. It has been responsible for photosensitivity of sheep and cattle in parts of Victoria and New South Wales where the plant is prevalent. So far no trouble has been reported in this State but no doubt this is due to the fact that there are no extensive areas of St. John's wort on grazing land. As with other plants which cause photosensitivity, unpigmented skin of animals is most likely to be affected.

The plant was formally used medicinally, St. John's wort oil made from the flowers infused in olive oil being used as a remedy for rheumatism and gout. A red dye extracted from the glands of the petals under the name of St. John's blood was applied to wounds and a yellow dye material was also obtained from the petals. It is no longer regarded as having any desirable properties except by some who are still inclined to grow it in gardens. It is a declared primary noxious weed for the State.

CONTROL

St. John's wort could be used to exemplify several different control methods. Cultivation, usually the first line of attack, when used independently, is not very effective for several reasons. The plant has a strong and persistent rooting system which is stimulated rather than suppressed by spasmodic cultivation. Machinery may also carry root fragments to clean areas. Grubbing is seldom completely effective as small portions of root left in the soil soon sucker freely. Again, much St. John's wort occurs on partially cleared land where ploughing is difficult to carry out.

The cheapest and most effective method where conditions are favourable is to provide vigorous plant competition. St. John's wort in the Manus Valley of New South Wales and other areas has been controlled by the Mt. Barker strain of subterranean clover along with a perennial grass such as *Phalaris tuberosa* where this is possible. The effectiveness of this method was shown by Moore and Cashmore (1942). It is essential to maintain a dense pasture cover to prevent re-establishment from seed. This involves appropriate fertiliser applications and management, particularly with reference to grazing.

The control of St. John's wort by competing pasture plants is due both to a reduction in plant numbers, and a decrease in vigour of individual plants, the former being of greater significance. Reduction in light intensity could be the main factor operating. Subterranean clover along with Kikuyu grass in particular, have helped considerably to suppress this weed in the South-West.

C.S.I.R.O research works have introduced a number of parasitic insects from other countries, mainly southern France and *Chrysolina hyperici* in particular has contributed to the control of St. John's wort in a number of localities. Where a sufficient build-up in population of this leaf-eating beetle occurs, the weed may be killed by repeated defoliation. In Western Australia the beetle has proved most effective where continuous areas of St. John's wort occur on cleared land. It has been less effective with intermittent infestations, especially in forest or partly cleared land, and maximum control has occurred when the weed has been competing with a vigorous pasture.

When the wort is growing on timbered land, not only is the parasite less effective but the establishment of pasture is seldom practicable. Under such conditions, quite good results have been obtained by the use of chemicals. Sodium chlorate was the first used on a large scale in this State. Seventy five pounds applied in 200 gallons of water per acre prevented seeding and killed a proportion of the plants but the treatment was costly and two treatments were required each year. A fair degree of control followed the application of crude salt at the rate of five tons per acre. This should be applied sufficiently early to prevent flowering but late enough not to be leached from the soil by heavy winter rains. At the same time the soil must be moist or sufficient rain fall to take the salt into solution so that is can be absorbed by the plant. The use of salt has a number of disadvantages, including high transport costs and difficulty of application, along with a restricted treatment period for maximum results.

With the advent of the hormone-like herbicides it was found that good control followed treatment with three pounds acid equivalent of 2,4-D ester per acre. The early flowering stage is regarded as optimum for spraying and usually occurs in November. A systematic programme each year has resulted in substantial reduction in the extent of St. John's wort. From time to time further areas are being found, however, and seedlings arising from dormant seeds must be expected for many years. 2,4-D ester is much cheaper than either sodium chlorate or crude salt and application is also simpler.

St. John's wort is tolerant of partial shade but does not withstand severe shading. A dense growth of pines has suppressed the weed but, following the removal of the trees, recovery from dormant seeds has occurred. The seeds retain their vitality for many years and, for this reason, the method has not proved satisfactory.

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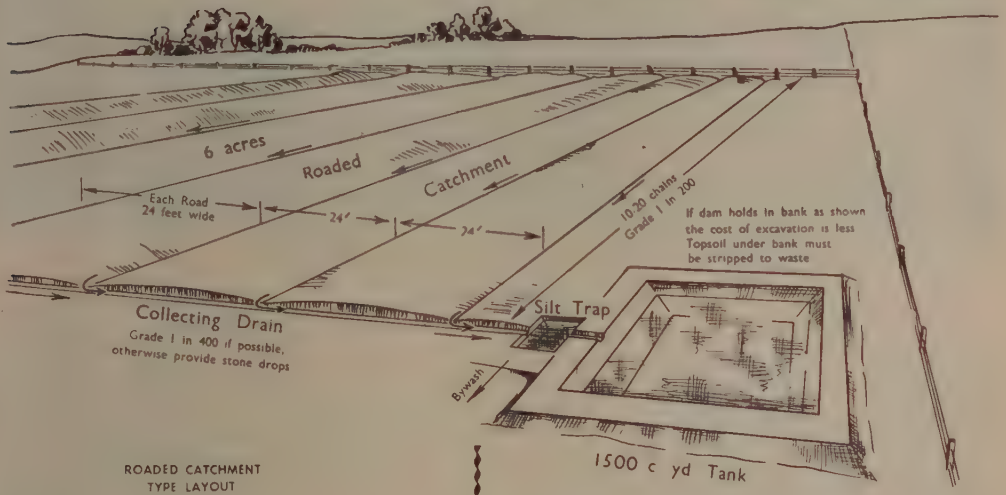
Arrangements have been made for the compilation of a comprehensive index to be incorporated in the December issue—a feature which will greatly enhance the value of the Journal as a work of reference.

ROADED CATCHMENTS FOR FARM WATER SUPPLIES



ROADED CATCHMENT
TYPE LAYOUT

Contributed by

THE PUBLIC WORKS DEPARTMENT
OF WESTERN AUSTRALIA

DURING the years 1948-51, the West Australian Public Works Department carried out a programme of drought relief storages in the south-eastern wheatbelt. These were in the nature of "key" storages and it was essential that they should contain water in the poor rainfall years when the farmers' supplies had failed. Many old Government dams were enlarged and rehabilitated in this period, and a unique opportunity presented itself to study the causes of success or failure in the older schemes in order to develop and improve the new works. An energetic team of Departmental engineers worked on this programme and all assisted in developing what has become known as the "roaded catchment" which was the outstanding achievement of this works programme.

One of the most enthusiastic of the engineers was the late V. C. Munt, M.E., M.I.E. (Aust.), who said: " . . . the institution of these roaded catchments for farmers is the greatest single advance in water conservation that has been made in this State."

BRIEF HISTORY OF DEVELOPMENT

It was observed that the amount of runoff from a natural catchment depended primarily on the intensity of rainfall. None of the natural catchments would run on falls of less than 75 points per day and many required more than an inch.

A well-formed roaded catchment at Brookton

Methods of catchment improvement such as burning of surface litter and scrub and rolling the surface were tried, but these did not make the catchments run on light rains.

The three million gallon dam at Lake Biddy, for instance, had a very large catchment of several thousand acres. The surface was reasonably good but very flat. This catchment did not run at all in normal years but in the odd good year, sheet flooding occurred. A long contour drain from the dam picked up about half a mile of gravel road and it was noticed that this drain carried water in quite light rainfalls. Several other similar instances could be quoted.

It was decided to try forming roads on the catchments of the key dams. The first experiment was at James Dam just north of Lake Grace. In the winter of 1949 a single road 16ft. wide by 1,000ft. long was constructed using a small horse-drawn grader behind a T.D.9 tractor. The road was rolled with a three-ton steel roller.

Alongside this road a similar strip was simply rolled to improve the surface but not graded. The whole area had been under cultivation for many years and the general slope was good for shedding water.

It was observed that the road ran extremely well on light rainfalls whereas the rolled strip did not run at all. This was conclusive proof that steep bare slopes are essential for shedding water. The water only had to travel a few feet on the average before it reached the drain at the side of the road and from there it ran away rapidly in a strong stream to the dam.

A further five roads were put in side by side using the Road Board grader and a rubber-tyred roller, making a total of about two acres. The roads all ran into a collecting drain at the lower end. The general results were most encouraging and it was decided to do much larger areas on the other key dams.

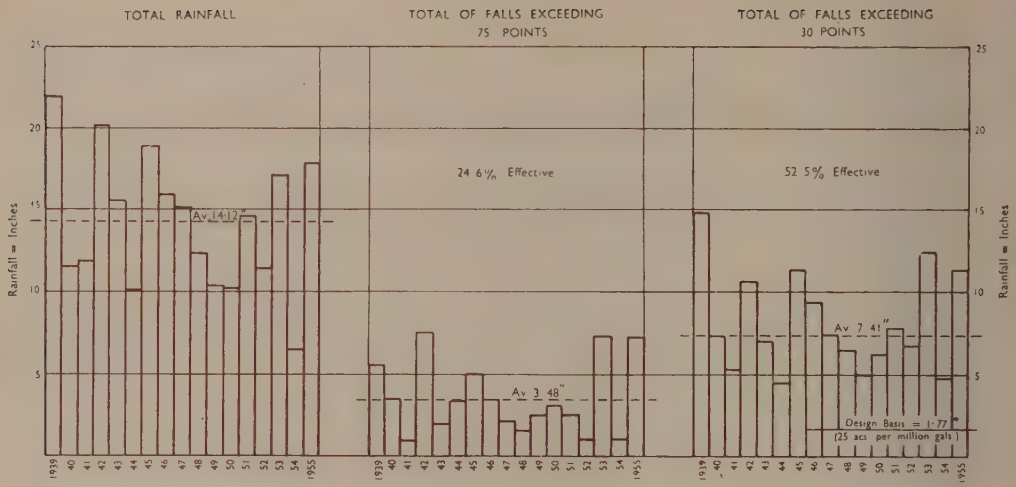
One serious fault was noticed at James Dam. The roads were put in on a grade of 1 in 100. This gave too high velocities on the lower sections of the roads which carry all the water, and led to erosion difficulties where the roads joined the collecting drains. Since this experiment, grades of roads have been limited to 1 in 200 except for short roads in good tight soils. Collecting drains must be limited to a grade of 1 in 400 or less provided with drops or concrete lined throughout.

THEORY OF ROADED CATCHMENTS

Much of the rain falling on wheatbelt catchments does not run off because it is either absorbed in the soil or it evaporates back to the atmosphere. If the rain is allowed to lie about or move only slowly, it will all disappear as fast as it falls.

A typical roaded catchment at Carnamah, showing collecting drain

The top photograph shows a grader forming-up a roaded catchment on newly-cleared land. Below, the rubber-tyred roller is being used to compact the newly-formed roads. Rolling is essential



Average % run off $\frac{1\cdot77}{7\cdot41} = 23\cdot8\%$ on effective storms over 30 pts.

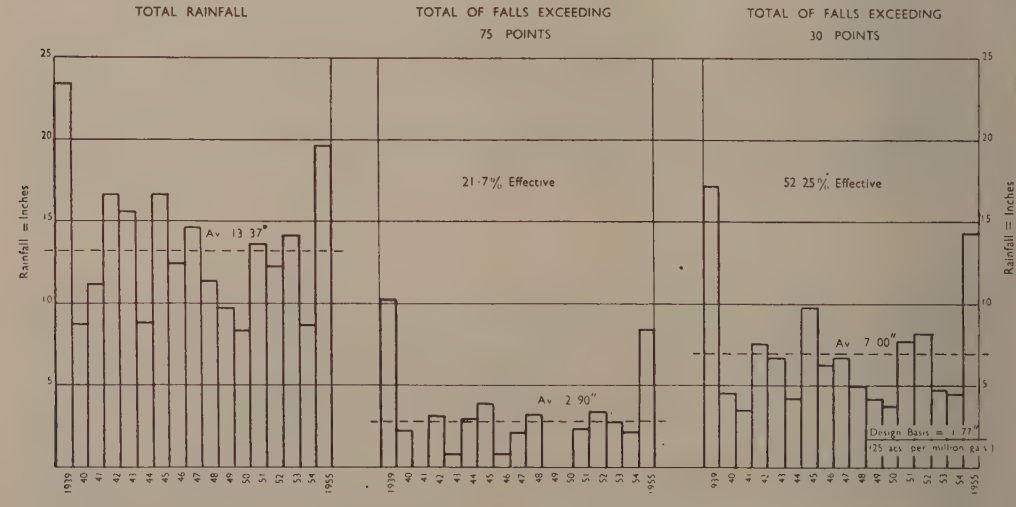
$\frac{1\cdot77}{14\cdot12} = 12\cdot5\%$ on total rainfall

KULIN
RAINFALL ANALYSIS
1939–1955

FIG. 1

In the roaded catchment the soil is compacted by heavy rollers to make it more impervious. The rubber-tyred roller used under moist conditions is doubly effective because it tends to produce a layer of finer material at the surface which is more impervious than the soil underneath.

The roaded catchment provides a relatively steep fall and the total result is that water runs off much more readily. Further, the path of travel is quite short before the water reaches the defined drains in the Vees between roads. Once in these drains the water will run at veloci-

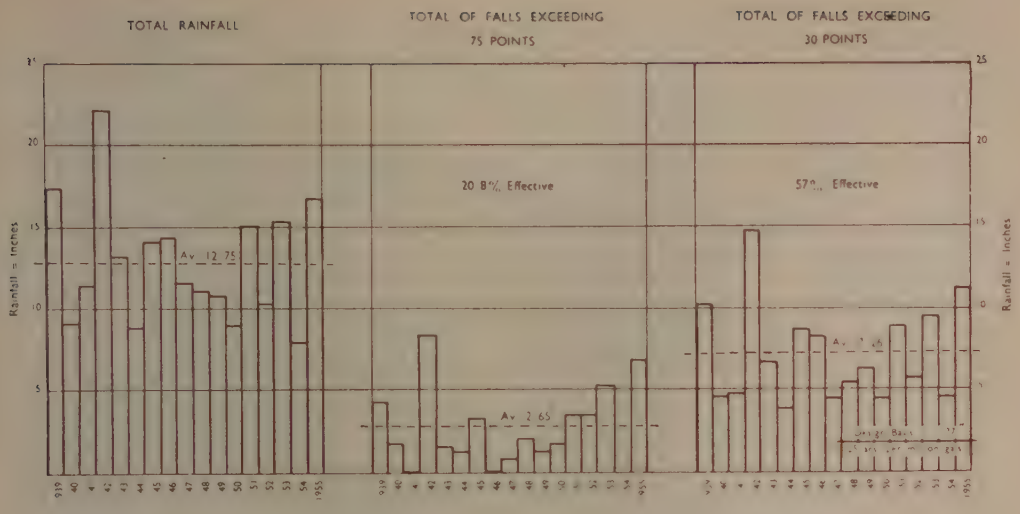


Average % run off $\frac{1\cdot77}{7\cdot00} = 25\cdot3\%$ on effective storms over 30 pts.

$\frac{1\cdot77}{13\cdot37} = 13\cdot2\%$ on total rainfall

LAKE GRACE
RAINFALL ANALYSIS
1939–1955

FIG. 2



Average % Run off $\frac{1 \cdot 77}{7 \cdot 26} = 24 \cdot 4\%$ on effective storms over 30 pts.

$\frac{1 \cdot 77}{12 \cdot 75} = 13\ 9\%$ on total rainfall

KONDININ
RAINFALL ANALYSIS
1939–1955

FIG 3

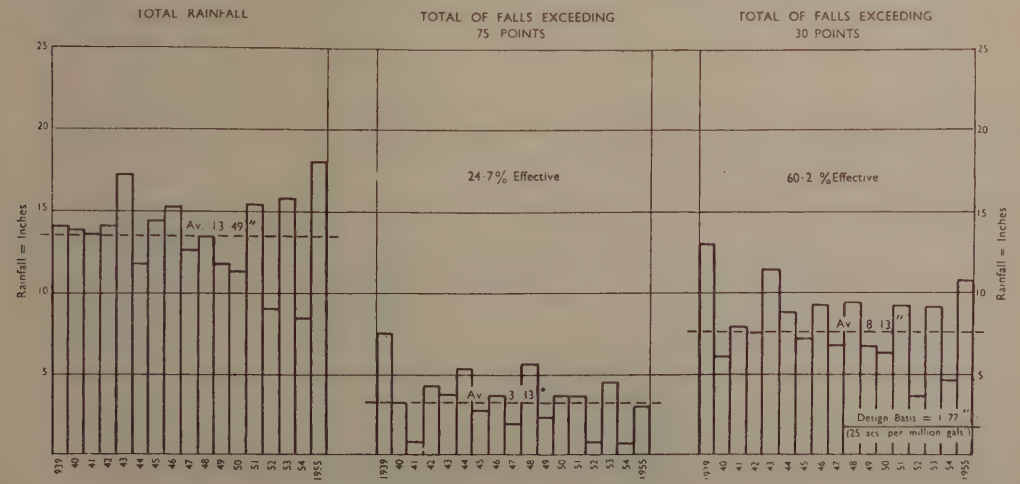
ties up to 2ft. per second, and 3ft. per second in the main drain, so that further seepage losses are kept to a minimum.

The effect of weeds and leaf litter is to hold up the progress of the water allowing it greater time to seep away and evaporate.

RAINFALL ANALYSES

With the knowledge that roaded catchments will in general run on 30 points or better, an analysis of daily rainfall records has been made to see how much rain would be effective each year.

Analyses were made for Kulin, Lake Grace, Kondinin and Dalwallinu as shown on figures 1 to 4. For the 17 years from 1939-1955, the total rainfalls are shown on the left and the total falls exceeding 30 points on the right. On the average this represents 52.5 per cent., 52.2 per cent., 57



Average % run off $\frac{1 \cdot 77}{8 \cdot 13} = 21 \cdot 8\%$ on effective storms over 30 pts.

$\frac{1 \cdot 77}{13 \cdot 49} = 13 \cdot 15\%$ on total rainfall

DALWALLINU
RAINFALL ANALYSIS
1939–1955

FIG 4

per cent. and 60 per cent. of the total rainfall respectively.

In the centre of these graphs is shown the total of rains exceeding 75 points which might have caused a good natural catchment to run. On the average, these amount to only 25 per cent., 22 per cent., 21 per cent. and 25 per cent. of the total rainfall respectively. Furthermore, about one year in three is a complete failure, these sometimes occurring in succession.

The design basis of Departmental roaded catchments is 25 acres per million gallons storage. This works out to an equivalent runoff of 1.77 in. per year and is shown in the figures. It can be seen that the percentage of runoff required is about 24 per cent. based on the average of effective rains over 30 points. In all these records an adequate runoff would seem probable without any failure.

SOIL TYPES

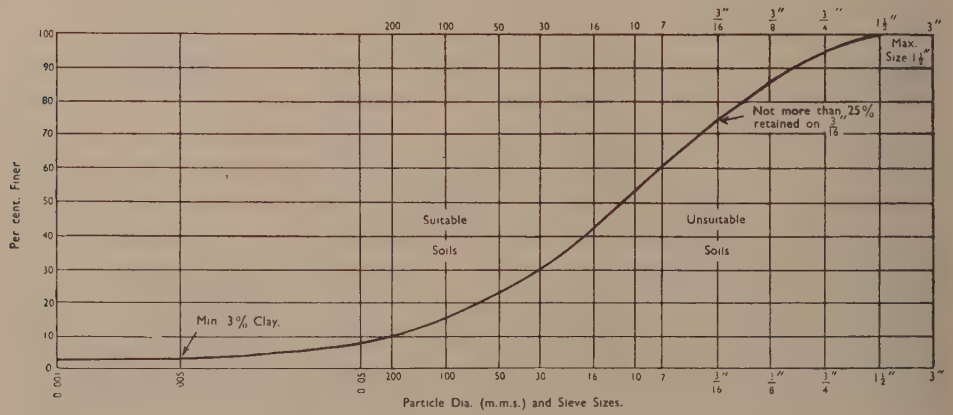
In the early work, heavy clay type catchments were naturally preferred but it was found that light gravelly or sandy soils could be roaded successfully using modern rubber-tyred rollers for compaction. In fact, rolling is so important that it should never be omitted or underdone. It is also many time more effective when the soil is wet than when it is dry. The minimum rolling time should be about 1½ hours per acre.

The grading curve in Fig 5 gives the limit in soil type from the experience of the Public Works Department. Briefly the percentage of clay should be 3 per cent. or greater and the percentage of gravel (retained on 3/16-inch screen) should not exceed about 25 per cent. Naturally less gravelly soils with more clay are to be preferred but this is not always possible.

On the other hand, extremely high clay contents are not desirable either. Such soils often become too sticky and slippery to roll properly and may tend to cake and crack after drying out.

In some parts of the wheatbelt the clay soils are very friable and crumbly. This is due to a high percentage of calcium in their make-up, and often nodules of calcium carbonate or lime are present. These soils are associated also with sinkholes and crabholes which are well known features of some wheatbelt areas.

The Department has sunk dams and constructed roaded catchments in calcium clays, filling in sinkholes where necessary. However, these soils do not compact very well and it is not recommended that they be used.



PARTICLE SIZE ANALYSIS

ROADED CATCHMENTS
CURVE SHOWING LIMIT OF GRADING FIG. 5

This view of a roaded catchment at Narrogin shows part of the collecting drain and a stone-pitched drop in the foreground

The possibility of replacing the calcium content with sodium by means of soda ash has been examined but the cost would seem prohibitive.

Another soil type worth mentioning is that known as solonetz, in which the top few inches are almost pure sand in the virgin state. Underneath is usually an extremely heavy clay with a rounded dome type of structure, each dome being some inches in diameter and divided from its neighbours by a crevice. These soils look hopeless for roaded catchment from surface indications but are, in fact, excellent, as the topsoil can be dozed off during clearing. The solonetz soil is betrayed by the

Roaded catchment at Narrogin showing some weed growth

vegetation it carries, i.e. salmon gum and mallee, etc., which is not characteristic of true sandy country.

THE KULIN CATCHMENT

This was the first large area of roaded catchment. An area of 100 acres was prepared in 1950 from virgin country to provide for the new 4.7 million gallon town dam.

The soil varied from a heavy mallee type at the lower end to lateritic sandplain at the higher end. The method used was to scrub-roll and allow to dry, burn, remove debris by hand and grader, grade and roll, remove more debris by hand or scrub rake and and finally re-roll.

This method proved slow and inefficient. The mallee and scrub was just broken off, leaving a lot of roots which gave trouble later with regrowth.

The present method adopted is to remove vegetation and topsoil by dozer into stacks or windrows and burn. The mallee roots are largely cleared out by this method. The grader forms the roads immediately and rolling follows.

The roads at James Dam and Kulin were 16ft. wide which proved too narrow, as the sides were too steep and short causing the roller to slip. The standard now is 24ft. wide with a side slope of between 1 in 10 and 1 in 20. This seems to be about the optimum.

Runoff from the Kulin catchment was observed from time to time with the following results:—

Date.	Rainfall. Pts.	Per cent. Runoff. % (Av. 28.4%)
1950—		
August 28	16	19.3
1951—		
January 10	42	26.3
January 16	40	23.3
March 29	47	*45.6
June 7	99	30.7
June 21	47	24.4
July 3	30	23.8
*Very intense.		
1952-53—		
July to March	Five falls over 30 pts., total 545 pts.	24.2

From these figures it can be seen that a lot depends on the intensity of the rain. Nevertheless it can be said that daily falls less than 30 points are generally ineffective while greater falls are effective and give an average runoff of about 25 per cent. on the total effective rainfall.

Various methods of deducting an arbitrary number of points for wetting the catchment have been tried. This approach is sound in principle but the number of points to wet the catchment varies tremendously with the intensity of rainfall.

THE NARROGIN CATCHMENT

An area of 50 acres of roaded catchment was constructed at Narrogin in early 1953 and provided with a flume and recorder for measuring rate of flow. A pluviometer was installed on the catchment also.

This area is in a higher rainfall belt than Kulin but the runoff data quoted here is for the winter of 1954 which was one of the driest on record.

The total rainfall from 21/5/54 to 8/9/54 was approximately 10 inches. The total runoff from the 50 acres was 3.93 million gallons, equivalent to a percentage runoff of about 35 per cent. In individual storms the percentage was as high as 71 per cent. from 98 points falling over a period of 10 hours. Sixty nine per cent. was obtained from 120 points falling over 56 hours. On the other hand, falls of 25, 20 and 19 points gave no runoff. An important factor in the percentage of runoff was whether the previous day's fall had been sufficient to wet the catchment.

The Narrogin catchment thus gave considerably higher percentage runoffs than Kulin. The main reasons would be better rainfall and possibly lesser seepage and evaporation losses.

The total area of this roaded catchment at Narrogin is 150 acres which was constructed in the main by the Main Roads Department whose assistance on this work and the general development of roaded catchments is acknowledged.

THE DALWALLINU CATCHMENT

A roaded catchment of 100 acres was constructed here for the town dams. The runoff has been extremely good but the winter of 1952 was a critical test. This was the worst winter in 23 years at that time and only 667 points of rain fell in the winter period.

Regrowth is slight on this roaded catchment at Carnamah

The total runoff was only 1.315 million gallons equivalent to 9 per cent on the total rainfall. No runoff was produced from falls of 38, 23, 30, 26, 23, 32 and 35 points which occurred in light drizzles lasting all day.

Since 1952, the Dalwallinu catchment has been progressively improved by cleaning up and rolling. This appears to have increased the runoff considerably as in recent years the 100 acres has been adequate for 4½ million gallons of storage, i.e., about 22 acres of roads per million gallons.

MAJOR DEPARTMENTAL ROADED CATCHMENTS

These might be listed as follows:—

	Acres.
Narrogin	150
Wicherina	100
Kulin	100
Brookton	100
Carnamah	150
Dalwallinu	100
Morawa	100
Tambellup	40
Total	840

In addition a large number of key storages have roaded catchments roughly at the rate of 25 acres per million gallons. The total is probably around 1,500 acres up to the end of 1955.

All of these catchments have been reasonably successful with the exception perhaps of Morawa and Wicherina. Morawa appeared to be a good catchment but never came up to expectations. The reasons for this have never been fully determined, but light rainfall, relatively hot climatic conditions with high evaporation losses and high absorption rates are the likely possibilities.

Wicherina catchment would have the same disabilities plus the fact that the soil was too sandy and the roads never appeared very impressive.

REGROWTH AND WEEDS

The problem of regrowth of mallee and scrub can be lessened by thorough bulldozing during construction. Regrowth must be attacked immediately in the first couple of seasons. Grubbing and flame throwers are used and the regrowth can be soon beaten.

If regrowth is left three or four years, it will reach a height of 6ft. to 8ft. in some cases and practically ruin a catchment.

Weeds are a problem on the crown of the roads. They do not often grow in the Vees as the subsoil is generally unsuitable. Weeds should be burnt off in early sum-

An example of a well-constructed dam on falling ground. Note how the bank holds water thus saving excavation costs. There is an outlet pipe running under the bank on the lower side, a cemented inflow, and provision for an overflow in the far corner

mer. In addition, they can be killed by spraying with an appropriate weedkiller early in winter. Sodium chlorate is perhaps the best of the various sprays available.

Weeds should not be removed by grading as this upsets the surface which improves as the years go by. The weed problem is worst in the first year or two after construction and will become insignificant if attended to.

FARMERS' CATCHMENTS

The ideal application of the roaded catchment is to the farmers' dam rather than to large town supplies. A typical dam and catchment is shown in the sketch at the commencement of this article.

The Public Works Department commenced a scheme for constructing catchments for farmers in the winter of 1952 using graders from the irrigation areas in their off season.

Up to the end of 1955 the Department has constructed 332 such catchments, aggregating about 1,350 acres. Of this number only six were done during 1955 because the Department had other grading commitments and did not attempt to "sell" the scheme, as it had done previously.

It is felt however, that when farmers fully appreciate the benefit resulting from catchment roading there will be a steady demand for this service which is done at actual cost.

The cost of 6 acres of roaded catchment is about £100. This is sufficient to fill a 1,500 cubic yard dam (250,000 gallons), poor years included. If one takes the annual charges on this outlay as £6 the cost of water stored is about 6d. per 1,000 gallons which is very cheap.

The roaded catchment has made exensive water conservation economically possible throughout the wheatbelt areas. For instance, an average farmer with say 3,000 acres can provide himself with a million gallon dam (6,000 cubic yards) for about £1,200. If he makes good use of sloping land and holds in bank, the cost is only about £600. The necessary 25 acres of roaded catchment would cost about £400 and extras such as stone-pitching

the inlet and bywash, provision of silt pit, offtakes, etc., would make the total cost about £1,200.

Such a storage makes the farmer independent and free from worries about droughts provided he looks after the catchment. The annual charge on the outlay at 6 per cent. is £72 for a million gallons of water per year. This amounts to 1s. 6d. per 1,000 gallons which is still extremely cheap. The price of water in areas reticulated from the Goldfields Water Supply Scheme is 4s. per 1,000 gallons for rebate and excess.

Because of the few fresh streams and rivers in this State and the high cost of piped supplies the necessity for farmers to provide their own storages using roaded catchments cannot be over-emphasised.

WATER HARVESTING

Many farmers, agriculturists and engineers are familiar with the work being done by Mr. Geddes at Badgery Creek near Sydney. About two-thirds of the farm is utilised purely as catchment for water storage. The remaining third of the farm is sprinkler irrigated from these storages and the overall production from the farm as a whole would appear to have been greatly increased.

The annual average evaporation at Badgery Creek is 43in. and the rainfall 26in. giving a ratio of precipitation to evaporation of 0.60 which is very much higher than for the wheatbelt areas of Western Australia. At Badgery Creek the runoff has been adequate, i.e. of the order 20 per cent., and more, without any catchment improvements so far.

Obviously this system does not apply to our wheatbelt areas in its present form, but with roaded catchments it would seem that the idea of water harvesting can be used with great benefit.

CONCLUSION

It should never be forgotten that every inch of natural rain on every acre amounts to nearly 23,000 gallons, or every 12 inches to 270,000 gallons. If the current price of water of 4s. per 1,000 gallons is applied, an annual rainfall of 12in. is worth £54 per acre per year. In this dry State of ours, we cannot afford to neglect this water potential. If even a small percentage can be conserved, the return in water could be by far the best harvest that the land can yield.

COVERS FOR JOURNALS

Owing to the rising costs of raw materials and labour, it has been found necessary to increase the prices of the binding covers and filing cases for "The Journal of Agriculture". The prices, until further notice will be as follows:—

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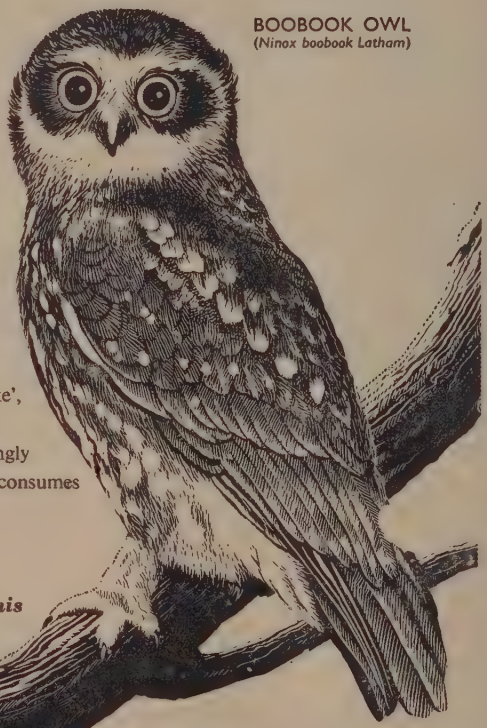
No. 2 of a Series of advertisements in the preparation of which leading ornithologists kindly assisted.

Friends of the Farmer

Roosting during the day in a hollow in a tree, the crevice of a rock or under the thick foliage of a tree, the Boobook Owl ventures forth at dusk to begin his nightly search for insects and small rodents. Found throughout Australia generally, this feathered friend of the farmer is also known as the Cuckoo Owl and the Mopoke. His well-known call resembles 'Mo-poke', 'More pork' or 'Boo-book'. Frequenting forests, usually singly or in pairs, the Boobook Owl consumes a variety of insects, some of which also are illustrated.

Another well-known friend of the farmer is his local agent for



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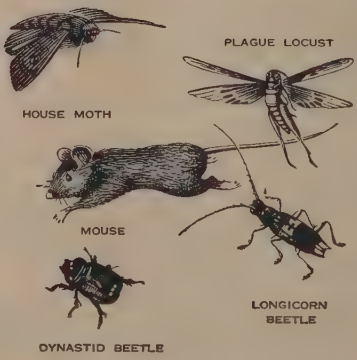

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BLOWFLY STRIKE

By M. BUTLER,
Sheep and Wool Instructor

BLOWFLY strike in sheep costs Australian flock-owners millions of pounds every year in sheep mortalities, reduced lambing percentages, restricted growth, lowered wool returns, loss of time and the cost of dressings for struck sheep.

These losses could be avoided—or at least substantially reduced—if all sheep-owners would take advantage of the proved methods of control that are available to them. And this does not mean merely sporadic attempts at blowfly control—it means incorporating these tried and tested methods into their systems of sheep husbandry—making them part of the normal flock routine, year in and year out.

In dealing with blowfly strike in sheep, while a knowledge of the habits of blowflies is helpful, it is more important to know why sheep are attractive to blowflies, which class of sheep are more susceptible to blowfly strike, why they are susceptible and what measures may be taken to reduce that susceptibility. This together with a knowledge of when conditions may be anticipated that will be favourable to the propagation of blowflies, will enable the sheep-owner to obtain the best results from any measures taken to protect his sheep.

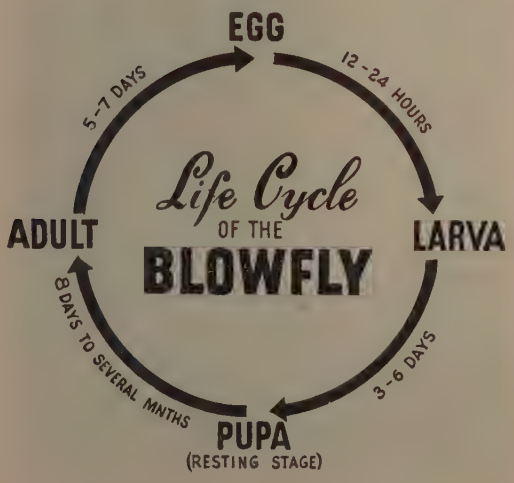


Fig. 1.—The life-cycle of the sheep blowfly shown in diagramatic form.

SHEEP BLOWFLIES

There are two main types of sheep blowfly—the so-called "primary flies" which strike the sheep in the first instance, and the "secondary flies" which follow them and strike the suppurating wounds caused by the primary flies.

The chief culprit in the primary class is the green blowfly (*Lucilia cuprina*) which is responsible for 90 per cent. of the initial strikes. The large brown and the lesser brown blowflies are also in the primary class but any successful measures against the green blowfly will be equally effective against other primary flies.

Although the secondary flies do not initiate the strikes, they are responsible for serious damage. Their larvae or maggots are bigger and more powerful than those of the primary flies and will attack and devour or crowd out the smaller larvae and take over the strike area entirely. The large hairy maggots of the secondary flies have powerful jaws that tear into the sheep's flesh and produce infections which often result in the animal's death.

LIFE-CYCLE

The life-cycles of all types of blowfly are fairly similar, and the diagram (Fig. 1) shows that this can be completed in 17 days where conditions of moisture and temperatures are favourable.

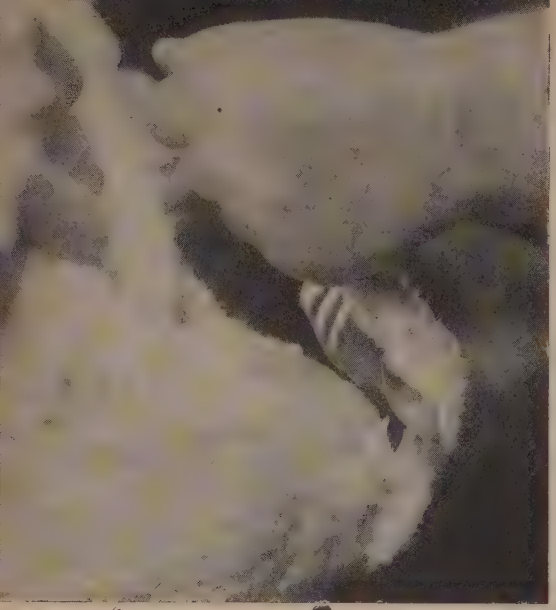


Fig. 2.—Correct tailing of lambs. Note that the knife-edge is level with the tip of the vulva.

Such conditions occur mainly during the spring and autumn months and are particularly prevalent in years when green feed is abundant.

From the egg to an egg-laying adult in 17 days means that generation after generation can follow rapidly, when conditions are ideal. The female primary fly can lay 2,000 or more eggs in her lifetime of 30 to 60 days so that a huge blowfly population can spring up in a short time.

HOW STRIKES OCCUR

Blowflies are attracted by moisture and by the odours arising from wool and skin which is constantly in a moist condition. Where moisture is retained in the wool, whether it be from rain, urine, heavy dews or sweat, a certain degree of "scalding" may take place.

The skin becomes inflamed and the exudate from the inflamed area adds to the moist conditions and gives off odours attractive to the primary flies. The flies lay their eggs and the larvae hatch out and travel through the wool to the skin to feed. As they grow and attack the surrounding tissues, so the infestation spreads.

SYMPTOMS OF BLOWFLY STRIKE

Badly-struck sheep suffer intense irritation and will often bite at the struck area in their attempts to gain some relief.

They usually separate from the flock, cease feeding and generally exhibit signs of uneasiness and discomfort.

If struck in the crutch—the most common site of blowfly strike—they will be seen stamping their feet and wriggling their tails.

In an extensive strike, the wool falls away leaving a raw surface in which bacterial infection often occurs and may cause death.

TYPES OF STRIKE

Crutch and tail strikes in ewes account for about 80 per cent. of all strikes occurring in sheep.

Fig. 3.—A correctly-crutched sheep. Note that the wool is shorn from the hocks and lower legs with sufficient width at the buttocks. The edge of the wool has been bevelled.

Pizzle strike in wethers and rams, also horn strike in rams is not unusual.

In years of excessive rainfall—particularly during warm weather when conditions are favourable for the occurrence of fleece rot—cases of body strike could occur if blowflies were plentiful.

SUSCEPTIBILITY

Most woolgrowers are aware that flies are not active all the year round, and that certain types of sheep are more susceptible to blowfly strike than others.

All Merino sheep are more or less susceptible, and in bad fly conditions even the plainest of Merino flocks can suffer a heavy incidence of fly strike, particularly in those years when green feed is in abundance and continued wetting of the crutch occurs.

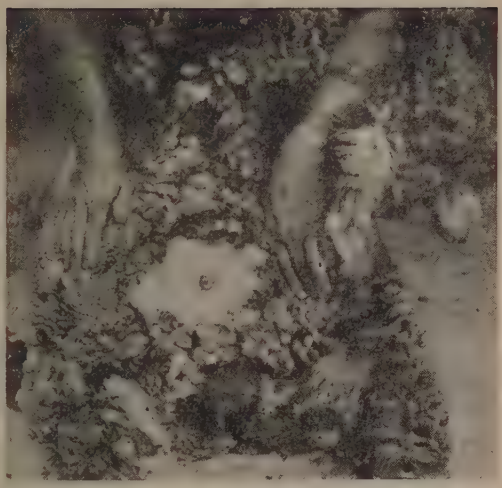


Fig. 4.—"Ringing" the pizzle of wethers and rams will help to prevent blowfly strike.

METHODS OF CONTROL

IN many Merino flocks there are some sheep that carry an excessive degree of wrinkliness in the breech area which renders them most susceptible to fly strike. These are likely to be poor wool-producers that would be better culled from the flock. This does not mean that all sheep showing development should be culled, but sheep that are obviously of poor type carrying excessive development and very short, heavy-conditioned wool are attractive to blowflies.

Such animals would most likely be the first sheep in the flock to be struck, forming the early breeding ground for subsequent generations of flies, which could rapidly increase and spread through the flock. Culling this type of sheep from the flock will assist in keeping the fly population down, and help in building up the wool average.

LAMB MARKING

The first step in blowfly control is correct tailing of lambs at marking time. Frequently one sees lambs or grown sheep with tails left too long, or cut too short, in fact there are many with no tails at all. Correct docking of the tail provides the sheep with a means of cleanliness, and tends to part the wool on either side of the vulva giving a better channel for urine. It also allows a brushing action of the tail that assists in keeping the bare area surrounding the vulva free from soiling. Tails should be docked at a length which allows the cut end of the tail to just cover the tip of the vulva. When the knife is used for tailing, as much bare skin as possible should be left on the underside of the tail which, on healing, provides a cleaner tail with a wool-free end.

CRUTCHING

At least two crutchings a year are an essential part of sheep husbandry in the farming areas to reduce soiling of the breech, and wool damage by staining and rubbing. Crutching also affords protection against fly strike by allowing free drainage and encouraging dryness of the crutch area, but to be effective it needs to be carried out ahead of anticipated fly activity. At best, only six or seven weeks' protection may be expected from crutching, as the regrowth of wool will again increase the sheep's susceptibility to blowfly strike.

Fig. 5.—Mulesing. Starting to remove loose skin from the crutch of a sheep.

RINGING

At crutching time, ringing the pizzle of wethers and rams will greatly assist in keeping these parts free of fly strike.

SHEARING

Freshly-shorn sheep are not very susceptible to fly strike unless shear cuts and wounds have become infected with bacteria during shearing, by contamination picked up in dirty yards, or by dipping off-shears in contaminated dipping solution. Such infections may be lessened by providing clean conditions at shearing and dipping time. Though protection may be secured through shearing, it is not always possible to coincide shearing with expected fly activity, particularly where growers are dependent on outside labour.

MULESING OF SHEEP

The Mules operation originated by the late J. H. W. Mules of South Australia, and modified by the C.S.I.R.O. and other research workers, is by far the most efficient of all methods of preventing blowfly strike, and is strongly recommended by the C.S.I.R.O. and Departments of Agriculture throughout Australia. It has gained wide popularity among woolgrowers, both agricultural and pastoral, throughout the Commonwealth. The function of the Mules operation is to extend or enlarge the wool-free area of skin surrounding the genital organs of ewes, which assists in keeping those parts of the sheep drier and freer from soiling, and less attractive to primary green blowflies.

When sheep are clean and dry in the crutch, flies cannot start strike and are unable to propagate. This factor in itself destroys the chance of fly waves building up on properties where flocks are Mulesed, and accounts largely for the very low incidence of blowfly strike in Mulesed sheep, often less than 2 per cent. The Mules operation not only confers a high degree of immunity upon the sheep, but assists in preventing primary blowflies from increasing in numbers. Where primary blowflies are unable to initiate strikes, the secondary or "hairy maggot" blowflies as they are often called, are greatly restricted in their activities.

Mulesing requires no special skill, and with a little practice can be done efficiently by any sheepman. It consists of the removal of two crescent-shaped pieces of skin from the crutch area of ewes, one piece from each side of the vulva. With the sheep held in position, start about one inch below the butt of the tail and, skirting the bare skin surrounding the vulva, complete the cut by tapering off to a point just above the hamstring. When the two cuts are completed, the widest part of the cuts should be level with the vulva, leaving a narrow bridge of skin about one to one and half inches wide just above the bare area. If the cuts are made correctly, the action of healing draws the bare skin out to its maximum width, greatly enlarging that area. This enlarged bare area surrounding the vulva assists ewes to remain clean and dry in the crutch, and greatly reduces their susceptibility to blowfly strike.

TAILSTRIPPING

The tailstripping of sheep, or the removal of the wool-bearing skin on the tail in such a manner that healing draws the undersurface bare skin around the tail, is an effective method of reducing tail strike. It can be applied to wethers as well as ewes, and is done in conjunction with Mulesing. The Mulesing and tailstripping of sheep

Fig. 6.—Left: Sheep held in crush ready for mulesing and tail-stripping. Right: The operation completed.

is a relatively simple procedure in which efficiency and speed are acquired with practice. It takes only one minute or less to do correctly. Sheep of any age can be treated without harmful effect, and heal very quickly. Even sheep in low condition appear to suffer no ill effects. Mulesing has the advantage of being a **permanent** measure of protection, and obviously is best done in the early life of the sheep.

Although it is a simple and easy treatment to perform, Mulesing is best learnt from a skilled operator by demonstration. Contact your local Agricultural Adviser or get in touch with the Officer-in-Charge, Sheep and Wool Section, Department of Agriculture, Perth, where officers are available to instruct in Mulesing and tail-stripping of sheep for blowfly control.

AGE TO MULES AND TAILSTRIP SHEEP

While sheep of all ages can be Mulesed and tailstripped successfully, it is best left to the individual grower to decide whether to treat his sheep as lambs, or at weaner age, according to what best suits his system of sheep management. Treating them as lambs is rather more tedious, but has the advantage of gaining earlier protection; but unless the treatment is carried out efficiently, some may have to be re-Mulesed as weaners. The best age to carry out the Mules and tailstrip operation is at weaner age, when sheep are showing development and at a time when they are freshly shorn or crutched, as it is difficult to Mules sheep carrying more than two weeks' wool in the crutch area.

Sheep management routine varies with each set of circumstances, and farm management where mustering problems are simple, differs from station routine, where sheep may only be mustered once or twice a year, and in some cases, can only be trapped on water during the summer months, and then be held for only a limited time, owing to feed scarcity. Under such varying conditions, any plan to make Mules and tailstripping routine practice would have to be evolved by the individual grower with due regard to the conditions and problems peculiar to his own property.

The best plan to follow is to Mules and tailstrip the weaner flock each year, either off-shears or at crutching time, provided flies are not prevalent and active, such as in the autumn and spring. In this way, over a few years, the whole flock will have become treated with very little extra work as one Mules operator can treat many sheep in a day.

Under pastoral conditions the Mulesing and tailstripping of sheep is without doubt the best protection that can be conferred

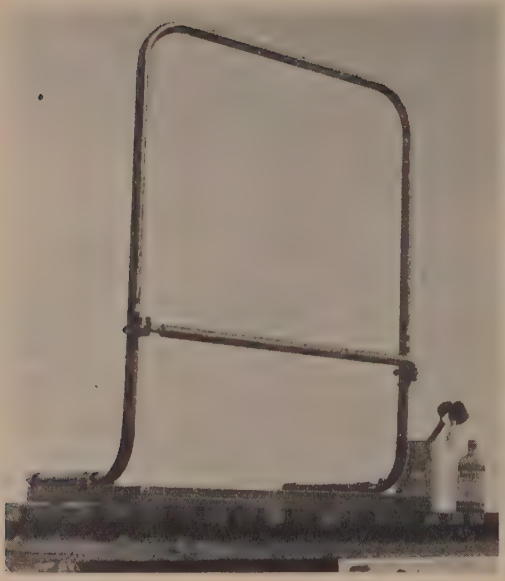


Fig. 7.—The holding crush used for mulesing and tailstripping.

on sheep. While of necessity a little extra work is involved, no great difficulty exists in carrying out this treatment.

This is already proved by the number of station properties which are achieving remarkable success by Mulesing and tailstripping, either off-shears if blowflies are not prevalent, on lambs at marking time, or at a midseason crutching.

EQUIPMENT REQUIRED

The equipment required to carry out the Mules and tailstrip operation on sheep, is a sharp pair of ordinary short dagging shears, an oilstone of medium texture, a container for antiseptic, and a small holding crush, similar to the one illustrated, which enables the catcher to easily control the sheep.

The holding crush can be made on the farm or purchased ready made for a small sum.

JETTING

Jetting is the application of a poisonous solution to the wool and skin of sheep. This kills maggots as they emerge and so prevents the strike from spreading.

With the introduction on the market of insecticides such as dieldrin, aldrin and similar chlorinated hydrocarbons with low volatility, protection from fly strike for lengthy periods may be gained by jetting sheep with these chemicals. To be effective jetting must be carried out in a thorough manner, saturating the wool right down to the skin.

The facilities required to jet sheep are an up to date jetting plant capable of good delivery at pressures of 75 to 120 lb. per square inch, and a race for holding sheep, preferably one that is raised above ground level. Although not essential, a raised race speeds up the job and is easier

Fig. 8.—Jetting plant on drum containing the jetting fluid. A raised jetting race is seen in the background.

Fig. 9.—Jetting sheep in a raised race.

on the operator. There are several types of small jetting plants on the market that are specially made for the job. Ordinary spray plants will not give proper penetration and are unsuitable. Multi-jet nozzles are better in use than single jets, as they expedite the work in hand.

A good system to follow when jetting sheep in the race is to have them all facing in one direction, and working from the rear, turn each sheep back as it is jetted. This allows the operator full freedom of action.

To jet sheep properly, the first approach with the jet should be up under the tail which causes the sheep to crouch slightly. Then using the free hand to brush the wool open, follow with the jet, first up one side of the crutch and then up the opposite side, finishing over the tail.

With a raised race, the operator works from the outside. A rubber glove should be used on the free hand, and protective clothing used in addition, owing to toxicity of the spraying solutions.

The lengthy period of protection these chemicals afford, is due to low volatilisation, and in this respect will not prevent flies from laying their eggs, but is toxic to the larvae hatched, and although it may take some hours to kill, is positive in its action. The number of sheep that can be jetted in a given time, will depend upon the facilities available and the aptitude of the operator, however, given reasonably good facilities many sheep can be jetted daily.

The recommended concentration, using dieldrin is 0.5 per cent. treating about five sheep to the gallon. Lower concentrations will shorten the period of protection, but it does not appear that higher concentrations will give longer protection.

Jetting is a sound measure of protection and should supplement Mulesing and tail-stripping, which is the basic fly control, whenever necessary.

Horn strike in rams and pizzle strike may be controlled by thoroughly saturating the wool around these parts with the jetting fluid.

THE DRESSING OF STRUCK SHEEP

During periods of fly activity, frequent inspections of the flock should be made, and any struck sheep given immediate treatment.

In addition to aiding the sheep, this helps in keeping the blowflies down by destroying the maggots before they are able to leave the wound and pupate in the ground, emerging later as adult flies.

To ensure the complete destruction of all maggots, the wool should be shorn from the struck areas and from the skin

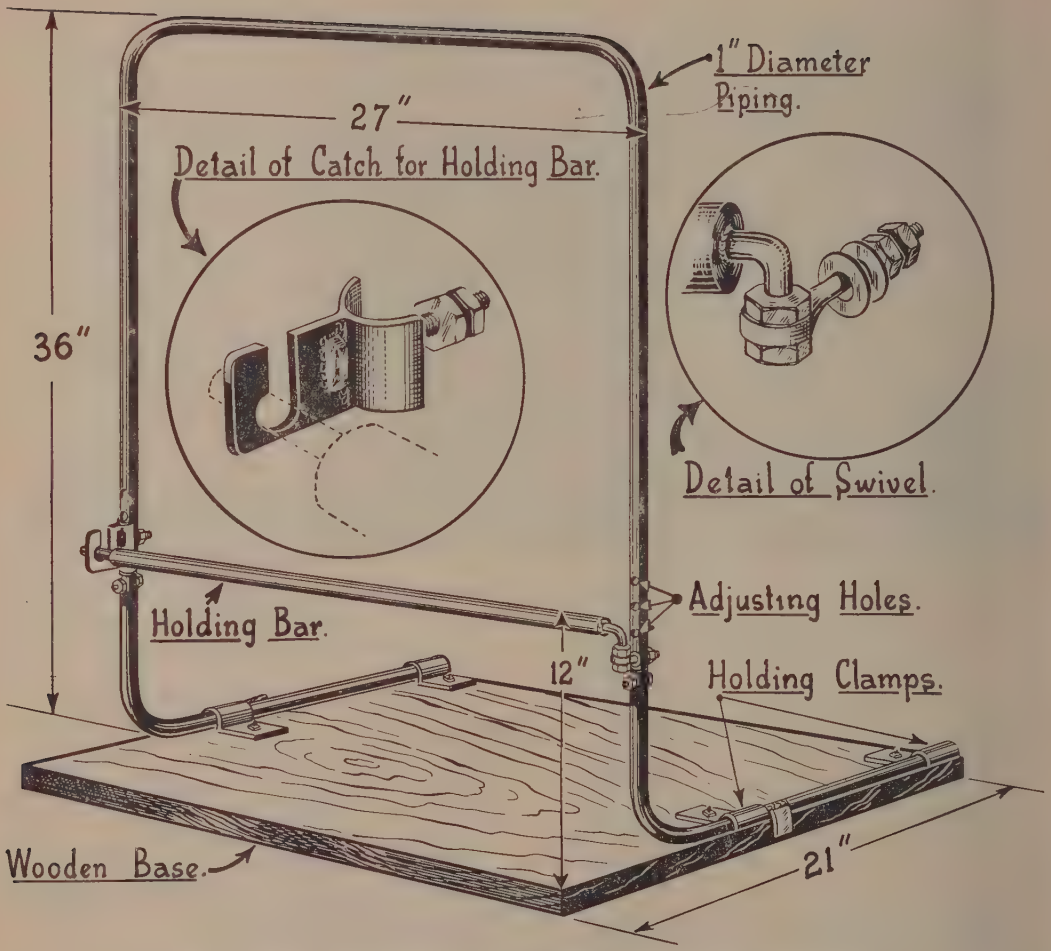


Fig. 10.—Diagram showing construction of crush for mulesing and tailstripping.

immediately surrounding them so that no pockets of infection are left unexposed. This should be done on a canvas sheet or tarpaulin, and the maggots destroyed immediately. The wound can then be treated with a suitable dressing that will destroy any remaining larva, and at the same time, assist the wound to heal.

Many kinds of dressings are used in treating fly struck sheep. Some of these are irritant in their action and harmful to the already damaged tissues in the wound.

Several dressings are made up as proprietary lines from a formula released by the C.S.I.R.O. These in the past have been found to be very successful. Any dressing used should be soothing to the wound and should assist in healing, as well as destroy the maggots in the wound.

Dressings should be applied over the whole strike area and well rubbed in to ensure good penetration.

POINTS TO REMEMBER

1. When tailing lambs make sure the cut tip of tail just covers the tip of the vulva.

2. The Mules operation and tailstripping of sheep is basic blowfly control—properly-treated sheep are permanently protected.

3. **Do not** Mules and tailstrip sheep when flies are prevalent and very active.

4. Mulesing and tailstripping enables sheep to remain drier in the crutch area.

5. Strike cannot occur in the absence of moisture in the wool.

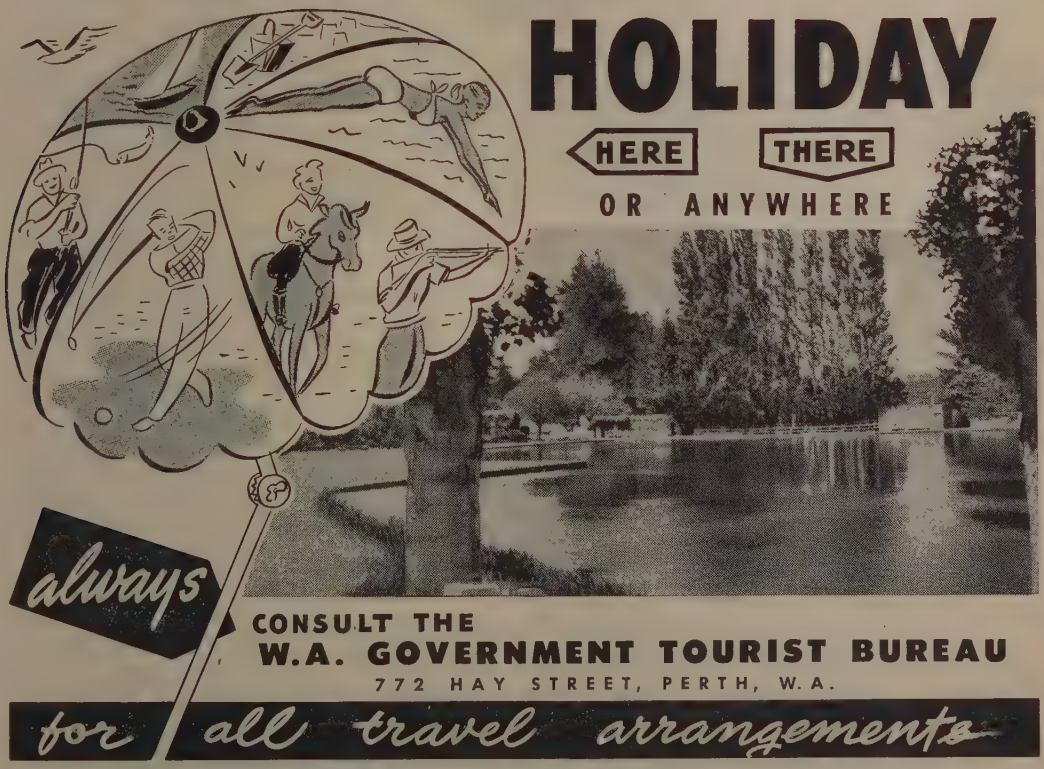
6. When blowflies cannot start strike, flywaves cannot build up.

7. Sheep of all ages can be Mulesed without harmful effects.

8. The best age to Mules sheep is as weaners.

9. Jetting should supplement Mulesing and tailstripping when required.

10. Jetting with dieldrin at 0.5 per cent. concentration should give up to ten weeks protection from flystrike. The jetting plant is a good form of insurance on the farm.



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INSECT Pests AND THEIR CONTROL

By C. F. H. JENKINS, M.A., Government Entomologist.

CODLING MOTH IN WESTERN AUSTRALIA

THE discovery of codling moth (Cydia pomonella L.) at Bridgetown in March, 1956, makes the seventeenth occasion on which this insect has been reported in Western Australia in a little over fifty years. The pest has never become firmly established in this State, but since 1903 outbreaks have been recorded at the following centres (Wickens 1928; Jenkins 1947):—

Albany	1903
Perth, four outbreaks between and 1913.	1904
Katanning	1913
Bridgetown	1915
Caversham	1918
North Dandalup	1924
Collie	1925
Narrogin	1926
Collie	1934
Mumballup	1937
Collie	1947
*Mullalyup	1951
*Nannup	1951
†Bridgetown	1956

Fig. 1.—Adult codling moth (greatly enlarged)

LIFE HISTORY

Under normal seasonal conditions, the first brood moths appear in the early spring and lay their eggs on the blossoming apple and pear trees. The caterpillars bore into the developing fruit and after reaching maturity eat their way out again and shelter in some suitable crack or crevice on or near the tree.

The second brood moths emerge during the early summer and the resulting caterpillars may be found in the fruit until well on in the season. After leaving the fruit, most of the second brood caterpillars seek out suitable hiding places in which they may carry over the winter, but some may pupate and give rise to a third brood of moths in late March or early April.

The overwintering caterpillars do not feed or travel unless disturbed, but they may be an important factor in the dissemination of the pest, as fruit cases, timber and other movable objects are often chosen as hiding places.

* Freed from quarantine in 1956.

† There is nothing to associate the present outbreak at Bridgetown with either of the 1951 outbreaks. The exact cause of the latest infestation cannot be proved definitely, but there is considerable evidence to suggest that the outbreak was caused by infested material brought overland from the Eastern States by one of the previous owners.

With the arrival of warm weather in the following spring the overwintering caterpillars pupate and give rise to another batch of first brood moths.

Fig. 2.—Apple cut open to show codling moth caterpillar in feeding position near core

SUITABILITY OF WESTERN AUSTRALIA FOR CODLING MOTH ESTABLISHMENT

Western Australia is probably the only extensive apple growing area in the world in which the codling moth is not established and strict quarantine regulations prohibiting the introduction of some fruits (apples, pears and quinces) were early introduced to protect local fruit growers. The long list of outbreaks demonstrates that no system of quarantine is perfect and shows that constant vigilance is necessary on the part of growers. The fact that 16 outbreaks have been successfully eradicated, however, has given rise to the belief in some quarters that this State is unsuitable for the establishment of the pest and it has been suggested that certain outbreaks have been recrudescenses of earlier infestations. The severity of several of the outbreaks has clearly demonstrated the ability of the pest to thrive under local conditions and the fact that long periods have elapsed between some outbreaks shows the unlikelihood of a pest such as codling moth surviving unperceived during the intervening space of time.

METHODS OF INTRODUCTION

In no instance has the exact cause of any particular outbreak been traced but it is not difficult to suggest several means by which codling moth could reach the State. During the war years, parcels forwarded from the Eastern States to troops stationed in Western Australia were found on several occasions to contain "codling" infested apples. With the improvement of air, rail and road transport the opportunity for ignorant or indifferent travellers to introduce infested fruits is ever increasing and is a constant menace. There are, however, other means by which "codling" caterpillars may enter the State. On leaving the fruit the caterpillars hide under any litter or bark to spin their silken cocoons and often choose a fruit or packing case for this purpose.

Apples reaching Eastern States jam and sauce factories would contain a certain number of "codling" grubs and there is always the danger that some grubs may spin in packing cases or other merchandise and be later carried further afield. The fact that most local outbreaks have occurred either at ports or busy industrial centres supports this contention.

It may be asked why several outbreaks have occurred at Collie in comparatively recent years while none have been reported in Perth since 1913. This is easily explained by the fact that at one time, apple and pear trees were not uncommon within the city limits and codling moths flying in the metropolitan area would have had little difficulty in finding suitable food plants. This is not the case at present,

Fig. 3.—Apples showing caterpillar bore-holes. Note injury or calyx of fruit

Fig. 4.—Apple on tree, showing holes bored by codling moth caterpillar

however, whereas in the Collie area there is a profusion of fruit trees including apples and pears in almost every backyard offering every facility to caterpillars or moths transported into the district.

CO-OPERATION BETWEEN MEMBERS OF THE PUBLIC AND THE DEPARTMENT OF AGRICULTURE

The successful eradication of previous codling moth outbreaks has been greatly facilitated by the ready co-operation of members of the public. In several instances early action has been possible only because growers and purchasers of caterpillar infested fruits have immediately submitted suspicious looking material to the Department of Agriculture for checking.

HOW TO RECOGNISE CODLING MOTH

The illustrations accompanying this article will indicate the type of injury caused by the "codling" caterpillar. The "grub" is pinkish in colour and slightly under ¾in. in length. There are several other caterpillars with which it may be easily confused, however, and growers are advised to immediately forward specimens to the Department of Agriculture should anything of a suspicious nature be encountered.

ERADICATION MEASURES

The action taken to deal with outbreaks of codling moth in this State has been designed to bring about total eradication rather than control. For this reason, the measures adopted locally have been much more rigorous than those applying in other parts of the world where good commercial control only is the objective.

Quarantine

Special conditions have been applied to the movement of fruit from defined "infested areas" and the removal of certain fruit from such areas has been totally prohibited.

Manual Destruction of Grubs

The careful inspection of infested trees and neighbouring structures such as fences and sheds likely to harbour pupating caterpillars has been intensively enforced.

Double hessian bandages around the butts of trees in infested zones have proved effective traps for the mature caterpillars, and the periodic killing of insects hiding in these bandages has proved a useful supplement to the insecticidal treatment.

Spray Programme

Arsenate of Lead was the main insecticide used against the early codling moth outbreaks but in recent years the emphasis has been on DDT.

The object of the spray programme is to maintain a constant insecticidal cover over the fruit and foliage throughout the active season of the codling moth. As the first moths may commence egg-laying in October and as the last fliers may not appear until March or April, repeated sprayings are necessary.

Details of the spray schedule will not be given here as the particular requirements may vary from time to time and from place to place. Growers implicated however, will receive full instruction from the Departmental Officers organising any eradication campaign.

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Wickens, G. W., 1928, Jour. Dept. Agric., West. Aust., Vol. V., p. 52.

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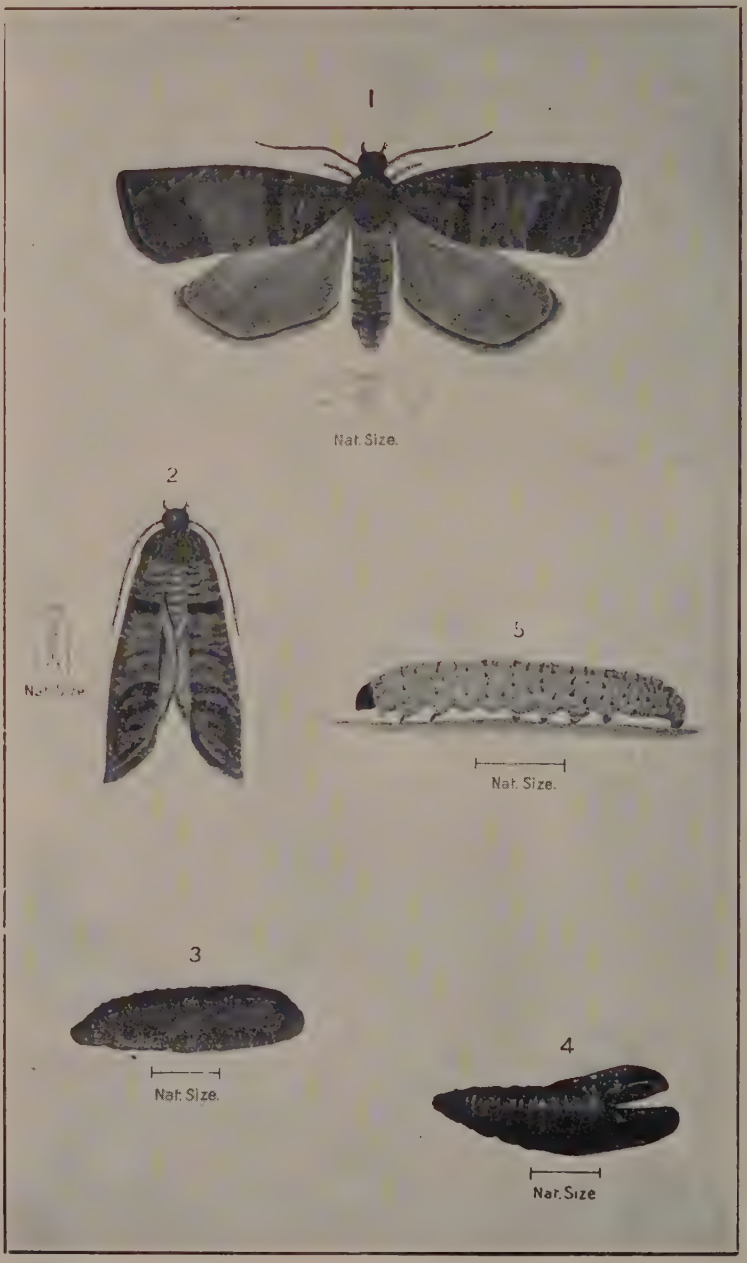


Fig. 5.—1, Moth on wing (magnified 4 times); 2, Moth at rest (magnified 4 times); 3, Pupa (magnified 3½ times); 4, Pupa case, after moth has emerged; 5, Adult larva or caterpillar (magnified 3½ times)

Build Your Own Low-Cost Library

By J. A. MALLETT

ALTHOUGH I have managed to acquire a fairly extensive library of farming books, I find that the most useful volumes on my bookshelves are not the products of the recognised publishing houses. For a number of years I have been making collections of the Department of Agriculture bulletins on various farming subjects. These, when bound and indexed for easy reference are far more informative than most of the standard publications.

This is quite understandable. Take, for instance the case of a farmer who spends three or four guineas on a book dealing with stock diseases. He usually finds that 80 per cent. of the book is devoted to diseases which he is not likely to encounter, or which he couldn't do much about, even if they did appear in his flocks and herds.

Because of the book's wide coverage, the diseases which are likely to be encountered in Western Australia may be dealt with somewhat briefly, and—as standard textbooks are not published at very frequent intervals—the treatments, preventive measures and other details may not be up-to-date.

On the other hand, the Veterinary Division of our Department of Agriculture has published bulletins on most of the diseases which occur among stock in this State—comprehensive articles covering cause, symptoms, preventive and curative measures. They are revised at fairly frequent intervals so that they incorporate the results of recent research work.

These articles usually appear in the Journal and are then reprinted in bulletin form, and these bulletins are available free of charge. By paying a small sum to have them bound, the farmer can obtain a cheap, but very informative book.

I found however that a disadvantage of this method of compiling a library was that just after I had bound all the available articles on a certain subject into one volume, another excellent article would be published and this would have to be held—perhaps for some years—until I could accumulate sufficient material for another book.

Some sort of loose-leaf arrangements which could be added to from time to time was the obvious answer to that problem, but nothing really suitable was available at a reasonable price.

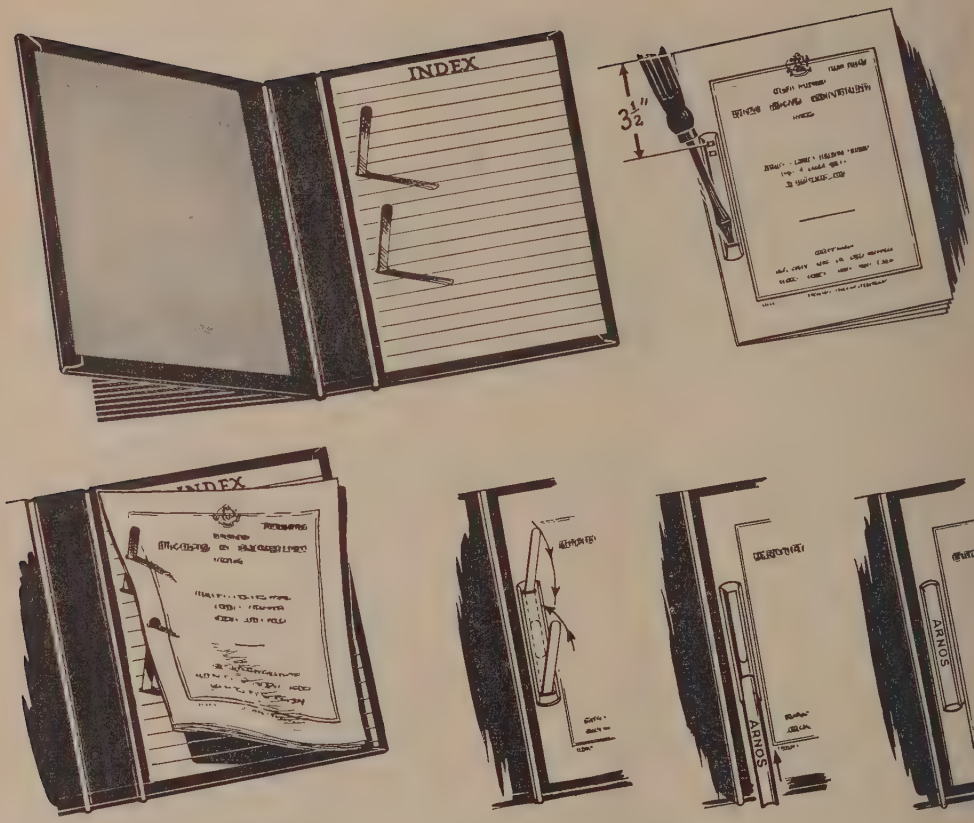
I discussed the matter with a Perth bookbinder and he was most co-operative. As a result of our talk he made up some inexpensive loose-leaf binders which proved ideal. I have several now in use and thought that I would pass on the information as I feel sure that many Journal readers would like to build up similar low-cost libraries.

CHEAP AND LASTING

The covers cost only 8s. each, including postage and they are made to last a lifetime, being fully cloth-covered on stout boards.

They measure about 8in. x 10in.—a convenient size which takes our Western Australian Department of Agriculture bulletins, also those of the C.S.I.R.O. and the Departments of Agriculture of Victoria, New South Wales and South Australia.

There is a ruled sheet for the index, and the width across the spine is about 1¼in. so that they will hold a good number of bulletins.



The loose-leaf attachment is a simple metal gadget with two thin flexible metal tongues; a grooved metal strip with slots to take the tongues, and a sliding cover to hold the tongues in place.

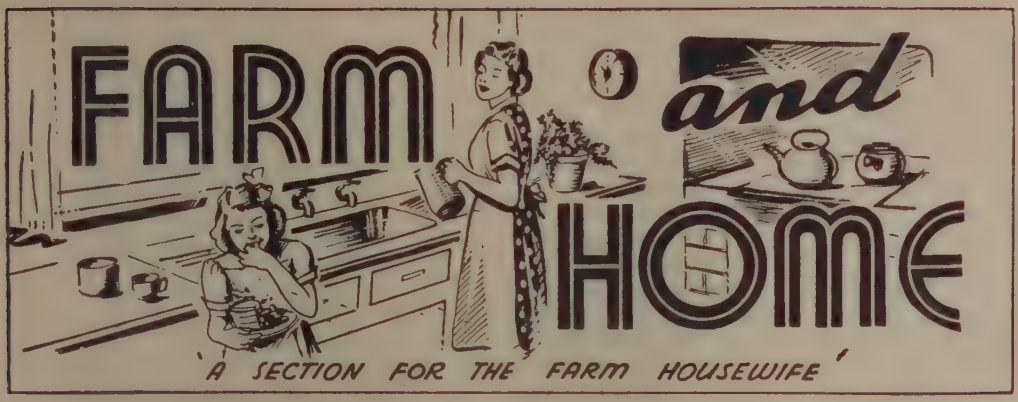
PREPARING THE BULLETINS

To make a neat job of filing the bulletins, measure down about 3½ in. from the top edge of each one, and make a pencil mark at this point. The grooved strip is placed with the top slot over the pencil mark and a narrow chisel (I used an old screwdriver ground to a sharp edge) is placed in the slot and given a tap to drive it through the paper. Repeat the operation on the lowest slot of the grooved strip and the bulletin is ready for filing. The diagrams show the idea.

MANY USES

At 8s. each, these covers are cheap enough for the average farmer to buy several so that he can make up books on sheep, cattle and dairying, weeds and poison plants, horticulture, insect pests, plant diseases, gardening, poultry or whatever subjects he is interested in. The housewife could make up a very useful volume of the "Farm and Home" articles, or by including some blank pages could make a useful scrapbook for recipes and handy hints.

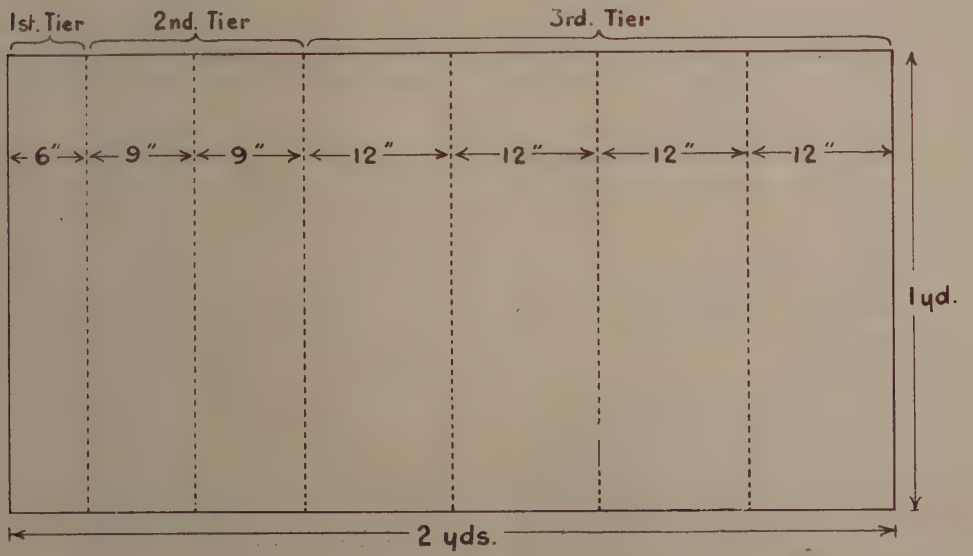
A full list of the departmental publications appeared in the September-October issue of the Journal, and I would suggest that the list contains sufficient good material for an excellent farm library. The loose-leaf binders are available from the maker—A. Pritchard, 130A Murray Street, Perth, at 8s. each.



A SIMPLE TIERED PETTICOAT OR SKIRT

By BRENDA CLEEVE

HOOPED and frilled petticoats are now enjoying a return to favour, but did you know that hooped petticoats were first introduced in the 16th century? Layers of frilly petticoats came into favour after Napoleonic times and indeed were so bulky and numerous that women would have lost the art of walking altogether had they not finally revolted against them and returned to hoops to hold their skirts out. These two fashions have been coming in and out of vogue since that time.



Tiered petticoats give a graceful, bouffant effect without adding undue bulk at the waist. A simple petticoat can be cut from two yards of material. This pattern can also be used for a skirt.

To cut the petticoat lay out the material as shown in the diagram above. These measurements are for a 27in. length which is long enough for most people. Extra length can be obtained by adding 1in. on

to each of the strips, when an extra ¼-yard of material will be needed, or by sewing a lace edging to the bottom edge—four yards of edging being required.

If the material is woven very straight, the strips can be torn off to give an even edge but this is often quite a risk, so unless you are sure, it is best to cut the strips off. The top tier consists of one short piece (6in.) and will be found sufficiently full without adding unnecessary bulk at the waistline. If the top tier is made any deeper it is usually necessary to add extra width to allow this tier to fit over the hip line. Where extra length is needed it is better to add it to the other two tiers.

The simplest method of assembling the petticoat is to sew the three tiers together and sew up the side seam.

Along one edge of the second and third tiers work two rows of gathering. Two rows will give a more even result when setting the gathers. Where the gathering is hand-done, one row will suffice as this pulls more easily. When doing gathering on a machine try using two different colours of cotton on the bobbin and reel. It is much easier to follow the thread you are pulling up. Once the bobbin and reel cottons are pulled at the same time, the stitches lock and the only thing to do is start again. After the gathering has been set and machined in place the threads used for gathering can be removed so that the different coloured cottons do not affect the final result. To join the tiers use one of these methods of neatening:—

(a) Binding on the wrong side.

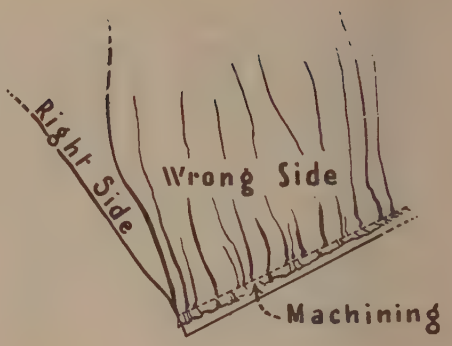
(b) Binding on the right side.

(c) Flat seam.

(d) Overlap.

On a petticoat which is to be stiffened it is best to use a method which encloses the raw edges completely. When raw edges are starched they are most uncomfortable to wear and spell ruin to stockings.

For the first method of neatening join the tiers together with the right sides together using a quarter-inch or half-inch seam. Neaten the raw inside with bias binding.



METHOD 'A'

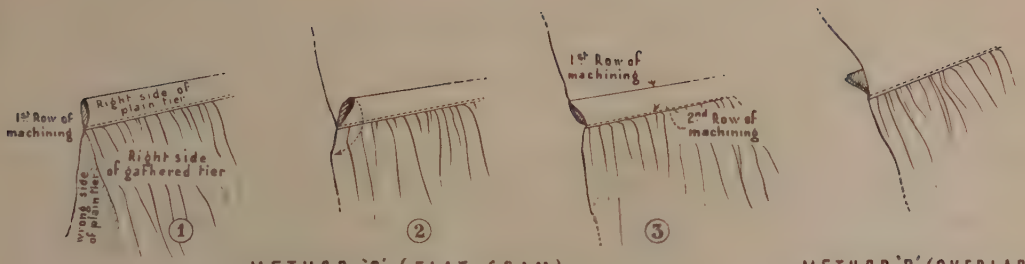
This same finish can be reversed to give a binding on the right side. This looks most attractive if a coloured binding or ribbon is used. In this case the binding must be attached more carefully as it will form part of the trim. The edge of the binding can be sewn down again if desired.

Joining by means of a flat seam is the method which requires more time and care but is one of the most satisfactory methods and is worth the extra trouble. To do a flat seam, turn down a ¼in. fold on to the wrong side on the plain (ungathered) edge of one tier. Place wrong sides together and slide the gathered edge of the next tier up into the crease of the fold. Tack to prevent slipping, and machine a quarter of an inch from the folded edge of the material. It is not essential to catch down the edge of the ¼in. fold, but it is important to catch the two tiers together.

Press the fold over to cover the raw edges, checking to see that there is no bump of material on the wrong side. Machine down the edge of the fold.

For the last method of joining, turn a ½in. fold to the wrong side on the plain edge of each tier. Place the fold over the gathered edge of the next tier and machine along the edge. The raw edges on the inside can be oversewn or bound with bias binding.

This method is the easiest one, if trimmings such as a contrasting piping, ric-rac or bobble braids are to be used as the trim can be inserted under the edge before it is machined down.



METHOD 'C' (FLAT SEAM) METHOD 'D' (OVERLAP)

The top edge can be finished with a hem wide enough to take elastic. For easy insertion and replacement of the elastic leave a ½in. gap in the machining along the edge of the hem. The gap can be sewn up by hand when the elastic is inserted and this is easily undone when necessary. This eliminates the necessity of working button-holes.

The lower edge can be finished by a hem. If lace is to be added the firmest finish is obtained by machining it along.

Broderie Anglaise edging is best attached with a tiny flat seam. The shaped raw edge should be straightened first. If this edging of lace is sewn without gathering it will be much easier to iron and there is sufficient fullness in the bottom tier.

A NEW IDEA FOR POT HOLDERS

By BRENDA CLEEVE

KEEP the pot holders in your kitchen bright and fresh by making them with removable padding. This saves tiresome drying of bulky fillings on wash day and the outside covering can be changed when it becomes soiled. One or two filling pads can be used for a series of covers to match your colour schemes or provide bright spots around the kitchen.

The easiest shapes to make are square or round. For a good-sized square holder use a piece of material approximately 18in x 8in. Hem or bind the two short sides. Fold these edges in to the centre of the strip so that they overlap about 1in. Machine along the raw edges. Turn the cover onto the right side and it is made.

Attach a small curtain ring or loop to one corner.

Round holders—which have the advantage that there are no corners to get burnt by coming in contact with the stove surface—are made in the same manner. Using a plate as a guide for size, cut one complete circle of frabic and two about 1in. deeper than a semi-circle. When a hem or binding is placed on the straight edges of the semi-circles there should be sufficient material to allow a 1in. overlap of these two pieces when placed on the full circle. Where there is only a small overlap it will be found that the filling falls out easily.

The filling should be made just slightly smaller than the cover. This can be made of any material such as wool, flannelette of even hessian. It need not be washable, as only the cover is washed and when soiled the padding could be replaced by a new pad. Make the padding of several layers of the material, depending on the thickness of the fabric. Sew the layers of padding firmly together with tacking or machine stitches.

Curtain rings used for hanging can be covered quickly by working a double crochet edge over the ring. This has the same effect as buttonhole but is much quicker and the ends can be left long enough to enable the ring to be attached.

CUTTING CAKES

By BRENDA CLEEVE

CUTTING cakes is usually a problem especially at party time when you want to cut economically without spoiling the appearance of the cakes. To cut a cake neatly a sharp knife with a thin blade is essential. Cut by keeping the point of the knife down and the handle up, pulling towards you as you work. Where the icing sticks to the knife and breaks away from the surface of the cake, dip the blade into a jug of hot water to keep it free while cutting.

To check the number of pieces you will be able to cut from each cake make a rough plan on the bottom of the tin with chalk or pencil. Allow a few extra pieces to compensate for variations in the size of the pieces cut and you should be able to calculate the number of cakes you will need. Butter cake mixtures will always cut into more pieces than sponges and lighter types of cakes.

ROUND CAKES

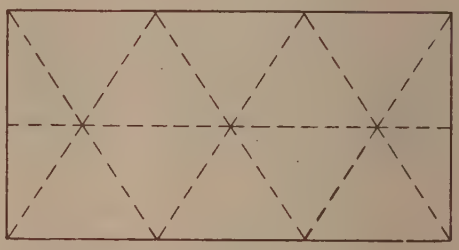
These often present difficulties especially with a large tin. In this case it is not very satisfactory to cut triangular-shaped pieces starting from the centre as the pieces are too large and hard to manage.

A better plan is to cut an inner circle about halfway between the centre of the cake and its edge. The outer ring and the inner circle thus formed can then be cut into pieces of a much more manageable size. An 8in. diameter cake cuts approximately 20 pieces with a sponge mixture.

Another method of cutting a round cake is to cut it into four across the centre to form a cross. Each quarter can then be cut into slices, reversing the direction of the cuts in each quarter. Some of the centre slices can be cut in halves as they may be too large. An 8in. diameter cake cuts approximately 20 pieces.

OBLONG CAKES

Shallow cakes baked in rectangular tins can be cut into triangular shapes either before or after icing. These shapes look quite attractive for cakes such as petit fours and party lamingtons. Cut the cake diagonally from one corner and make several cuts on this angle until the cake is in slices. Starting from the other end cut in the same manner to form triangles with diamonds between. If the cake is wide and the centre diamonds are too large cut down the centre so that all the cake is cut into triangles.



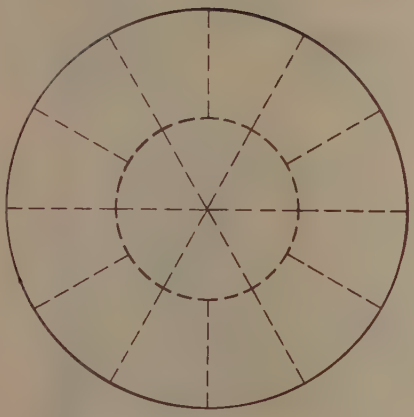
OBLONG CAKE

A large square cake can be cut on the same principle. Cut it first into two or four oblongs and then cut each one according to the directions for an oblong cake.

A square cake can also be cut into quarters and then each section cut into four again. Cut diagonally across each section so that each original quarter cuts into 8 triangular shaped pieces.

HEART-SHAPED CAKES

This is an awkward shape to cut with any system. Probably the simplest method is to cut the cake down the centre and then across in slices in the opposite direction. Some of the larger slices can be cut again.



ROUND CAKE
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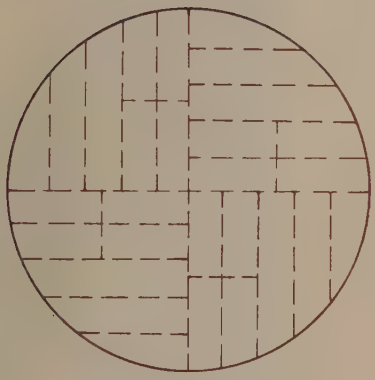

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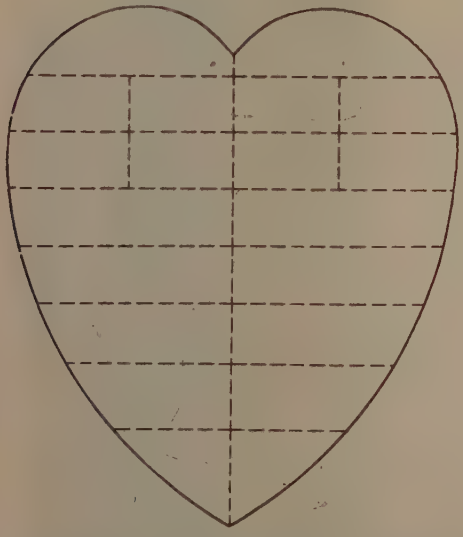
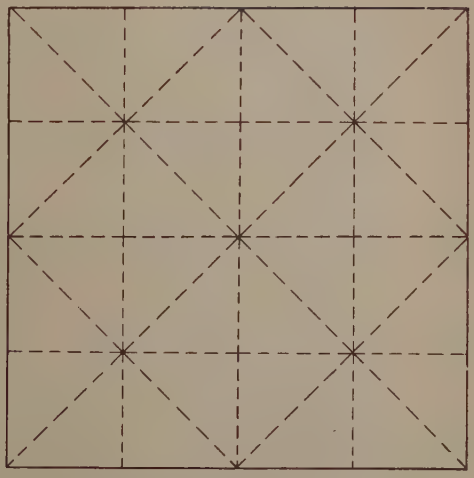


HEART SHAPED CAKE



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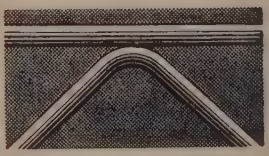

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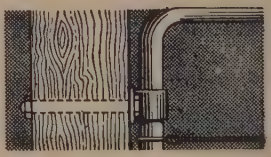

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IRRIGATION PROJECTS

On North-West Stations

By W. M. NUNN,
B.Sc. (Agric.),

Officer-in-Charge,
North-West Branch

OPINION varies considerably as to the economics of irrigation projects on station properties. Some consider that they offer a potential that should be assessed and developed wherever possible, while others incline to the view that the effort and capital put into them would always be better spent on improvements leading to better management of the broader acres of the general grazing area.

The truth of the matter undoubtedly lies somewhere in between these extreme views, and a separate decision must be made for each station according to the opportunity and need in each case.

There are many stations which have the water and soil, and which could produce reserves of fodder at much lower cost than they eventually pay for it in drought periods.

Fig. 1.—An uncut crop of lucerne, Doman Estates, Wiluna

Fig. 2.—Baled lucerne hay, Doman Estates, Wiluna

There are probably some instances also, where the time and interest lavished on the lucerne plot may have detracted from management requirements farther from home.

One thing is certain, and that is that if the job's worth doing, it's worth doing properly. If you really have the water supply, the soil and the opportunity, then you should get reliable advice and make a thorough job of it.

Eight tons of lucerne hay per year is a reasonable yield to expect per acre, and lucerne hay, well made and stacked on the property, is probably worth three or four times as much in feed value as the indifferent cereal hay which is landed on the station in time of need, at perhaps £30 or £40 per ton.

In this article it is not intended to urge stations into lucerne production, but simply to bring to the notice of station people the wide range of possibilities, and to show, principally by means of illustrations, the varied methods in operation on North-West and Kimberley properties.

In the Murchison area, Mr. Finch at Lorna Glen, Doman Estates at Wiluna, and Mr. Meehan at Austin Downs, have each grown upwards of 20 acres of lucerne in recent years. Water in each of these instances is pumped from wells or bores which tap supplies in water bearing fluviatile sediments at comparatively shallow depth.

At Wiluna the water is only 12-20 feet down, in a series of wells, and five 3-inch low level centrifugals, separately operated by small stationary engines, deliver a total of about 30,000 gallons per hour to the irrigation channels. Mr. Fowler who manages this project, claims that he gets eight cuts per year and averages 25 cwt. per cut.

Fig. 3.—The furrow opener in operation at Lorna Glen

Fig. 4.—Main channel and bays at Boolaloo Station, photographed shortly after planting operations in August

Mr. Meehan has a central powerhouse in which a 34 h.p. Ruston Hornsby engine supplies 440-volt, 50-cycle A.C. current, to operate a series of electric motors driving vertical spindle centrifugal pumps at the water points. He is one who hopes to expand his lucerne operations as a major part of his station operation and sheep-feeding programme.

Mr. Finch is about to start a very interesting system to try and make his water go further than it did with conventional flood irrigation. He now has about 50,000 gallons per hour from five bores, each separately equipped with engine and pump, and he will send this water over comparatively large areas via a system of furrows which he has made with a furrow opener of his own design and construction, pulled by a 60 h.p. crawler tractor. He is counting on the hard pan a few feet down to spread the water laterally from these furrows.

In Kimberley there are a number of small-scale projects using water from river pools. Perhaps the two that serve best to illustrate the method and problem in this region, are Liveringa and Noonkanbah.

At Liveringa the soil is rather heavy for lucerne, but *Paspalum scrobiculatum* and *Clitoria* give promise as a pasture and hay crop. The electric motor at the pump on the billabong is operated by power line from the main station powerhouse, which seems to operate just everything on Liveringa, and, as can be seen from the illustration, there is provision for running the motor and pump up a 20ft. tower to clear flood waters when the Fitzroy really flows.

Fig. 5.—Lucerne under sprinkler irrigation at Yeelinnie Station, Wiluna

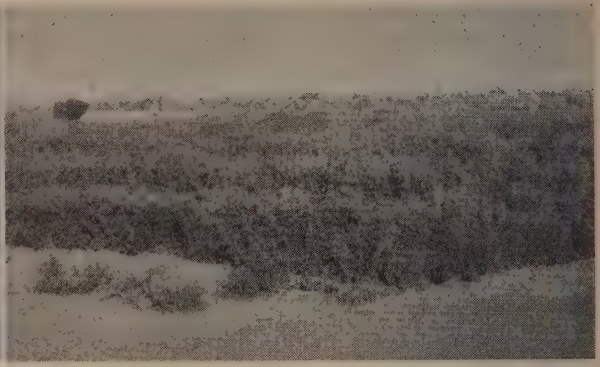

Fig. 6.—Left—One of a series of electric motor and vertical spindle pump outfits at Austin Downs Station. Right—A dense stand of lucerne on the property

At Noonkanbah the lucerne plot is clear of flood waters, but the pump again has to rise and fall with the river level, so the pump and engine are mounted on a pontoon anchored to the river bank.

Fig. 7.—The main channel and irrigation block at Liveringa Station (top), with the pumping outfit, showing provision for raising it above flood level

Boolaloo, on the Ashburton River, is the site of the most ambitious of station irrigation ventures yet started. Here Dr. B. Rumich, a former officer of the Department of Agriculture, has gone into partnership with the Barrett-Lennard Bros. of Boolaloo Pastoral Co. The partnership calls itself Ashburton Development Pty. Ltd., and their aim is 200 acres of lucerne producing 2,000 tons of lucerne hay per year, and providing, regularly, the main proportion of the feed ration for probably 8,000 sheep.

Water is pumped from a pool in the Ashburton River. A 7-inch and a 4-inch centrifugal between them, deliver at a rate of 140,000 gallons per hour, and cutting and baling will be carried out on 40 acres of lucerne and 30 acres of Sudan grass this summer.

Next year they hope to increase plantings at this site to water 100 acres of lucerne, and then to duplicate the entire installation at another river pool a few miles downstream.

The better management of station country, getting away from the continuous grazing practice which inevitably leads to the disappearance of the better feed

Fig. 8.—Left—Noonkanbah Station has its pump and engine mounted on a pontoon so that it can rise and fall with the river level. Right—The lucerne crop at Noonkanbah in 1951

species and their replacement by less desirable types or by soil erosion, must be our number one urge for the pastoral areas in general. But where lucerne production is practicable on a worthwhile scale, it is not difficult to imagine seasonal handfeeding playing an important part in future, in enabling a station to defer grazing at appropriate periods on areas selected for regenerative treatment.

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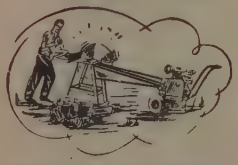

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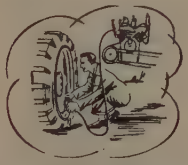

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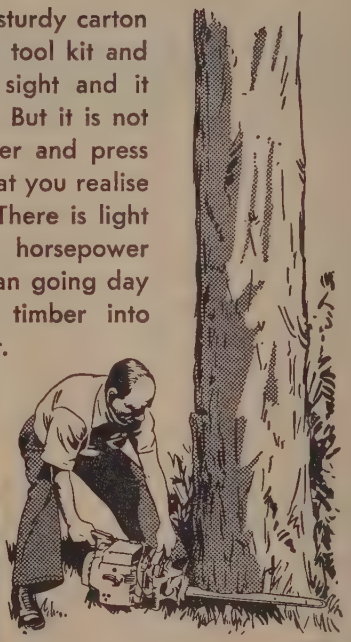

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Fig. 1.—Tuberculosis of the pleura of a cow. This is the condition often referred to as "grapes."

By J. SHILKIN, B.V.Sc.,
Senior Veterinary Surgeon

TUBERCULOSIS

TUBERCULOSIS is a disease of considerable importance, both from a public health point of view and because of the economic loss to the State occasioned by the destruction of affected carcases of cattle and pigs condemned at slaughter houses. It is widespread throughout Australia, but since 1938, when energetic steps were commenced to eradicate the disease from the metropolitan dairy herds of Sydney, considerable progress has been made in its eradication in the milk supply herds of all States.

The cause is a micro-organism known as *Mycobacterium tuberculosis,* of which there are three strains, human, bovine, and avian.

The Human Strain affects humans chiefly, but can affect dogs and cats and more rarely, cattle.

The Bovine Strain affects cattle and pigs chiefly, and horses, dogs and cats rarely. Humans, particularly children, are also susceptible to this strain.

The Avian Strain affects poultry and pigs chiefly, humans rarely. Cases of tuberculosis have been recorded in sheep and goats but they are very rare.

METHOD OF INFECTION

While the inhalation of the tubercle bacillus is probably the usual route of infection in humans, both inhalation and ingestion with the food are common routes in cattle and pigs. Infected cattle either cough of breathe out the bacilli into feed boxes or on to walls of dairies. Infected saliva may also contaminate feed boxes or the saliva may be swallowed and the tubercle bacilli passed out onto the pastures.

Tubercle bacilli are not particularly resistant to sunlight, and fortunately many would be killed in this manner. At the same time, in protected positions, such

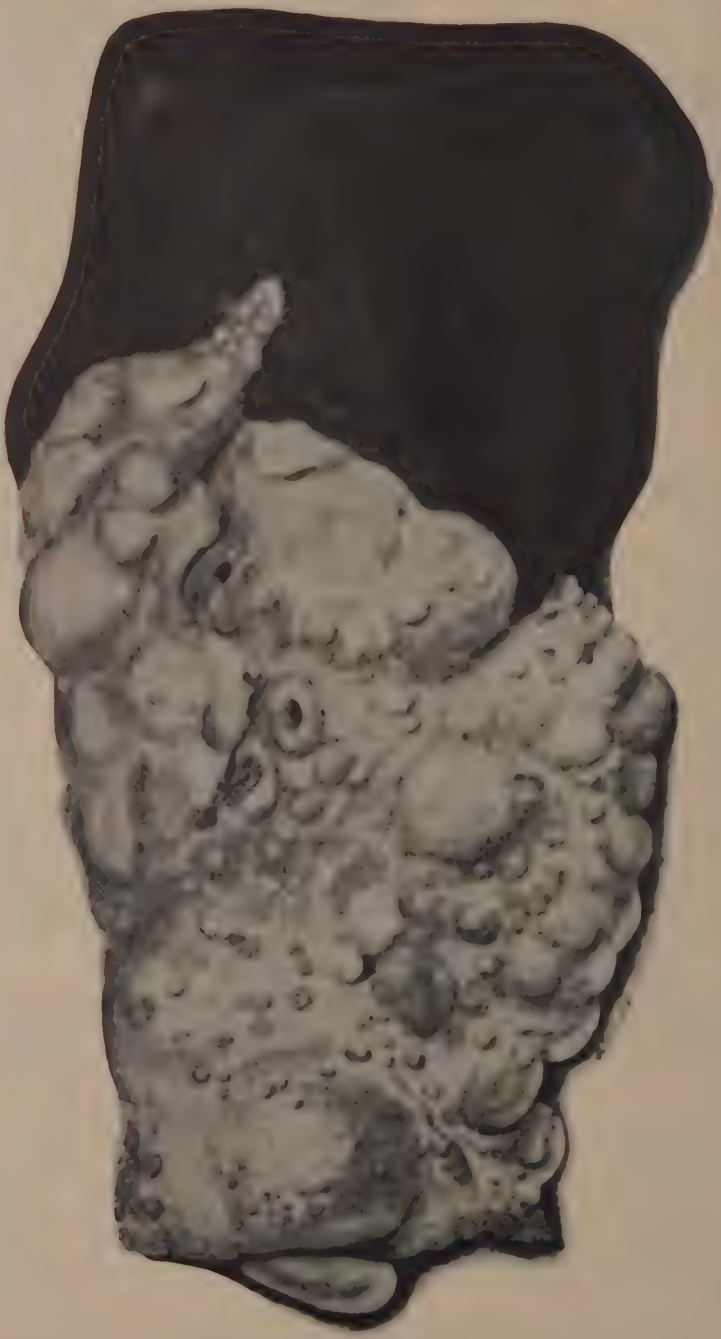

Fig 2.—Tuberculosis of the liver in cattle

as feed boxes or under large clumps of trees, bacilli can live for quite considerable periods. One would expect, therefore, a more rapid spread through the herd where bail feeding in closed sheds is practised, and in the field this has often been found to occur.

In the case of pigs, milk from tuberculous cows which are passing the bacilli in the milk is often the cause of heavy infection. However, pigs have frequently been heavily infected by grazing over the same pastures as infected cattle. Water can also be a means of spread of the organisms and streams, creeks, etc., flowing from a heavily infected to a neighbouring property may result in infection in cows on that property.

Suspectibility.—Contrary to a widespread belief, no particular breed of cattle or pigs is more susceptible to the disease. However certain animals in individual herds appear to have a degree of resistance to infection.

SYMPTOMS

In the majority of cases, cattle or pigs may be affected for years without showing any symptoms. In a small proportion of cases, where the superficial lymphatic glands are involved, swellings may be seen below the ear (parotid lymph gland), under the lower jaw (submaxillary gland), in front of the shoulder (prescapular gland), above the stifle (precrural gland), or above and behind the udder (supramammary gland).

In cows, where the lungs are affected, a characteristic and persistent cough usually occurs. When the lymphatic glands of the throat are affected, a peculiar snoring noise is often evident, such cows commonly being referred to as "snorers."

Whilst cattle without symptoms or with any of the symptoms described above may live and maintain their condition for years, occasionally, due to some lowering of resistance brought about by poor feeding, drought conditions, strain of calving, or any other factor which may lower resistance, the disease may progress rapidly within the animal's body. Such animals rapidly become emaciated, usually cough, particularly if driven, and may die within a variable period.

In pigs, as with cattle, symptoms are not usually seen, but in advanced cases animals may be emaciated, cough frequently, and possibly have diarrhoea.

POST MORTEM APPEARANCE

Cattle.—As cattle may be affected in almost any organ of the body, the post mortem findings will naturally vary considerably depending on the location of the disease.

The lymphatic glands are the organs most generally affected. In the very early stages these glands will be swollen and flabby, but quickly develop small yellow cheesy areas which develop in size and later become calcified (chalky). The lesions then are creamy or white in colour, due to the deposition of lime salts, and when cut have a gritty feel.

Of the other organs the lungs and liver are most frequently affected. In the lungs tuberculous abcesses are scattered throughout the lung tissue, whilst the adjoining bronchial and mediastinal lymphatic glands will also show tuberculous lesions in most cases. In some advanced cases masses of tuberculous nodules may cover the pleura (lining of the chest cavity)—the so-called "grapes."

In the infected liver the typical tuberculous abcesses will be seen, varying in number from one or two to large numbers throughout the tissues.

Pigs.—As the usual method of infection in pigs is by ingestion, sites usually affected are the lymphatic glands of the throat, head, and intestines. Lesions in pigs do not usually exhibit the characteristic yellow coloured material found in cattle, but are generally paler in colour.

PUBLIC HEALTH

The disease can be transmitted to humans through infected milk. Whilst adults are relatively immune, children up to the ages of about 15 to 16 years are particularly susceptible. Tuberculosis so contracted often results in a crippling condition due to infection of the spine or joints. In very young children bovine tuberculosis of the intestines has been responsible for death.

Fortunately only a small proportion of infected cows pass the tubercle germs in the milk. However, as these germs may be

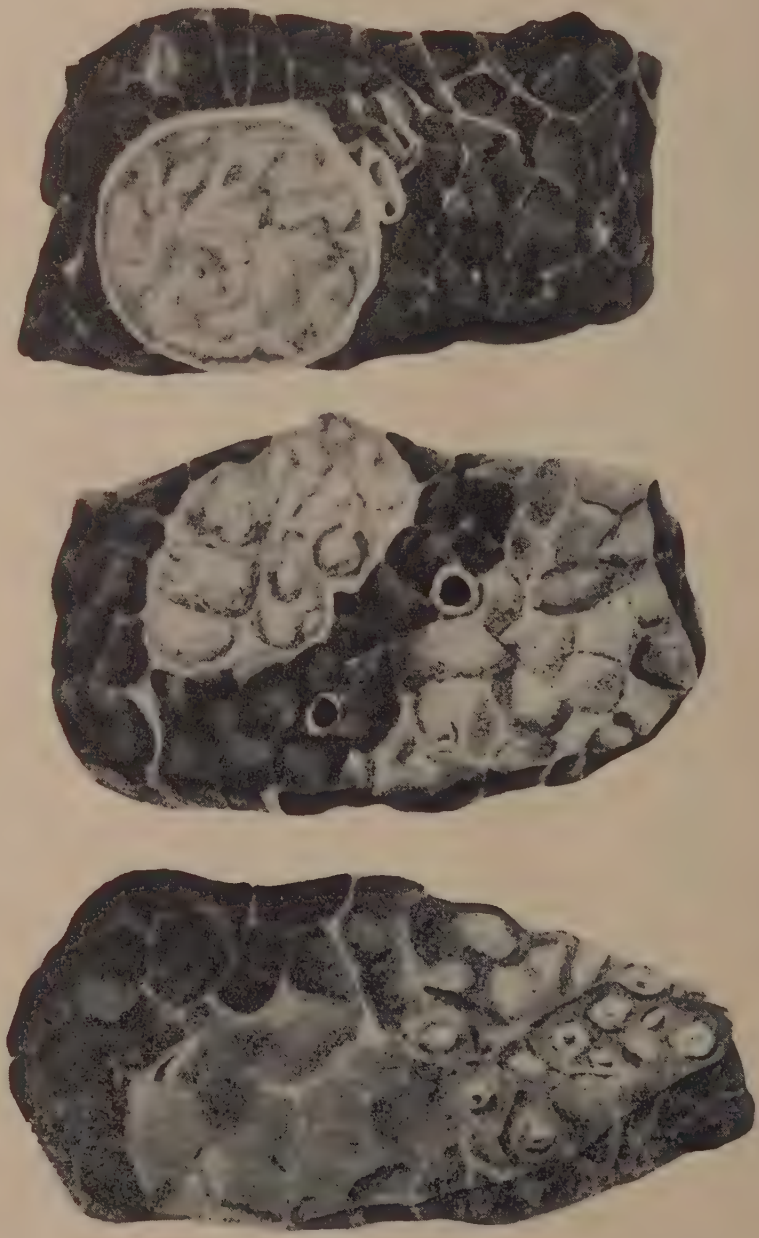

Fig. 3.—Tuberculosis of the lungs in cattle

passed intermittently rather than continuously, diagnosis involving examination of the milk may be misleading. In any case, detection of the tubercle germ in the milk requires guinea pig inoculations and a period of 6 to 8 weeks before results can be ascertained. Except for special purposes, therefore, milk examination is of little value in the detection of tuberculosis in cows.

DIAGNOSIS

Visual diagnosis is only possible in animals showing emaciation, particularly accompanied by a persistent cough, or in those animals exhibiting infections of the superficial lymphatic glands where the swellings are obvious to the naked eye.

Owing to the difficulty in diagnosing the disease in the majority of affected animals, special tests have been devised. The tuberculin test as used at present is a most reliable diagnostic agent, enabling tuberculosis animals, both cattle and pigs, to be detected and eliminated from herds. As these tests, by law, can only be carried out by qualified veterinarians, there is little to give details of the methods employed, except to mention that the test in general use at present consists of an injection into one tail fold followed by examination of the site of injection in three to four days.

CONTROL

As there is no treatment which is known to be successful in curing tuberculosis in in stock, control must be based on the ability to locate tuberculous animals, followed by their destruction. For this purpose, the tuberculin test may be used in both cattle and pigs.

In dairy herds, particularly where hand feeding in bails is being practised, removal of tuberculous cattle should be followed by a thorough disinfection of feed boxes, walls, water troughs, etc.

Where cattle and pigs are run together, any attempt at eradication in the pigs must be preceded by testing of the cattle and disposal of re-acting animals.

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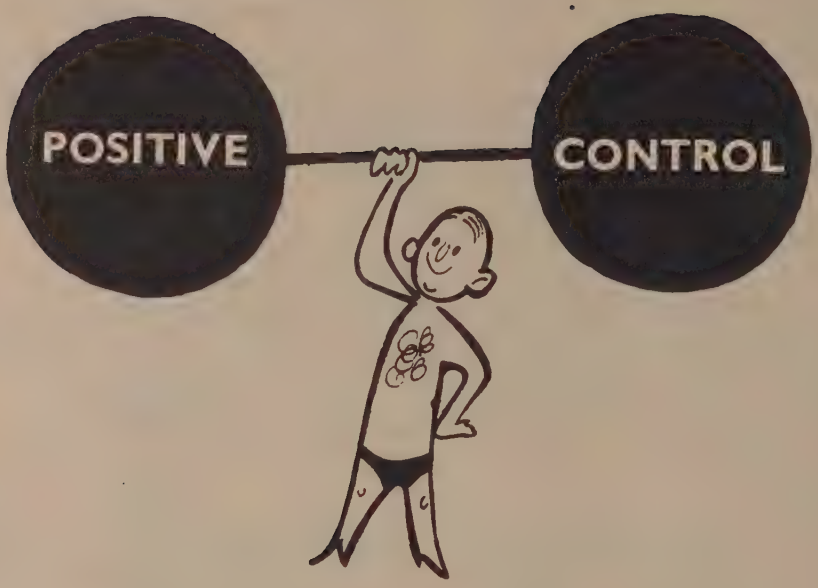

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FLEECE MEASUREMENT IN SELECTING MERINO SHEEP

By
I. K. STOTT,
B.Sc., (Agric.)
Sheep and Wool Adviser

DURING recent months a number of well-attended fleece measurement demonstrations have been held in various districts. The object of the demonstrations was to make stud-breeders familiar with the technique under shearing-shed conditions and, during discussion, gain a clearer understanding of fleece measurement and its application to stud-breeding.

From a small group of sheep, the stud-breeders selected those they considered carried the heaviest and lightest fleeces. The whole group was then shorn and the fleeces weighed, classed and valued.

The demonstrations have shown definitely that selecting for fleece weight by eye and touch is inefficient compared with the scales.

Fleece measurement used in conjunction with present methods of classing increases the accuracy of selection of Merino sheep. It has grown from your desire as flockowners to have a better assessment of your sheep as producers and breeders.

The purpose is to determine by objective, or real measurements those animals which are going to be the best commercial producers during their lifetime and by using the best as breeders to secure the greatest genetic advantage for flock improvement.

Scientific observation has shown that in classing sheep by eye appraisal we are subject to error in picking the best (and the worst) producers. Undue emphasis is often placed on points which have little effect on productivity. Also, in eye-classing it can be difficult to maintain constant standards from the beginning to the end of classing time and from day to day.

Fleece measurement aims to overcome these difficulties by—

(a) Weighing and recording the shorn or greasy fleece weight (G.F.W.) of individual sheep.
(b) Determining the yield of clean wool from the fleece by scouring a typical sample from it to get the clean wool weight (C.W.W.).
(c) Measuring the average diameter of the fibres in fleece. This is a true indication of what is termed the count of the wool.
(d) Measuring the average staple length.
(e) Noting and recording the classers' comments.

In practice, the use of these measurements is modified according to the importance of the sheep. Stud rams, for instance, should be measured in great detail, whereas flock ewes only warrant greasy fleece weight measurements.

Selection by fleece measurement need only be applied once in the sheep's lifetime. It is only useful when sheep of the same age raised in similar environments are compared. The two-tooth shearing is the ideal time to make measurements.

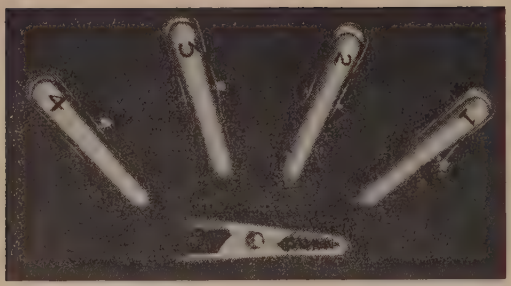

Fig. 1.—Numbered alligator ear-clips used for temporarily identifying individual sheep.

Any further selection during the sheep's lifetime should be based on age and breeding ability.

To be a useful and practical aid, fleece measurement must "fit in" with normal shearing shed routine. Experience has shown that this is possible. Once the procedure is understood by shearers and shed hands, one extra man can easily do the fleece measurement work, necessary in the shed, for three shearers.

HOW IS FLEECE MEASUREMENT APPLIED?

First, you must decide on what type of sheep to aim for. As a Merino breeder you will probably want sheep that are able to survive and produce the maximum quantity of wool of a specified type. They must also have the ability to reproduce and rear as many lambs as possible of this type.

Then you must decide on what percentage you wish to cull.

Primary Culling.

You, or your classer, then cull on obvious faults, some of which are:—

Faulty testicles or udders;
Very badly over or undershot jaws;
Poor style wool, poor frames etc.

This culling should be kept to a minimum so that as many as possible can be selected on measured production. The more characters considered, the less chance there is for advancement in any one, and the one you are interested in is wool production.

In the Shearing Shed.

The sheep that are left are then identified in some way. A numbered ear tag is often used. A temporary alligator ear tag is suitable and can be affixed to and removed from ear very quickly. The wool on the midside is then clearly marked with a raddle. (This is the point on the third last rib half way between the mid-line of the back and the mid-line of the belly which is most typical of the whole of the fleece.)

As the sheep is shorn its number is noted on a card. Fleece and belly weights and classers' comments are recorded against this number.

A four-ounce sample is taken from the midside, placed in clearly labelled container and forwarded to the laboratory.

At the Laboratory.

From this typical four-ounce sample, staple length, fibre diameter (quality) crimps per inch and amount of clean wool (after scouring) are determined.

Results.

Results are tabulated and a list showing you the number of the sheep, its greasy fleece weight, clean wool weight, staple length, fibre diameter, number of crimps per inch and fleece type is available to assist in the final selection of your top sheep.

Fig. 2.—Marking the midside of the sheep with raddle so that a sample can be taken from this area after the animal is shorn.

It need not necessarily be that the sheep with the highest G.F.W. is the one you select. The extra weight may come from grease or an increase in strength. However, you will agree that, with such a list, your final selection of the sheep that will grow the maximum quantity of the desired quality wool is much more accurate.

That this is so, is proved by many tests conducted by C.S.I.R.O. in the Eastern States.

In comparing the scales with eye judgment they have shown that eye judgment is only 30 per cent as efficient as the scales for raising fleece weights, and only 50 per cent. as efficient for raising monetary returns.—(Which would you use?)

HOW IS THE IMPROVEMENT ACHIEVED?

Selection in animals is for two main purposes.

(1) To improve the average production of those that are retained.

(2) To improve the production of future generations by using the best producers as breeders.

It should aim to make the difference between the average production of those selected and the average of the group before selection as large as possible so as to secure the maximum benefit.

Fleece measurement can help to do this.

Current Flock Improvement.

The repeatability of fleece weight in Merino sheep is approximately 0.7 or 70 per cent. This means that, on the average, sheep selected at the two-tooth shearing with a superiority for fleece weight of 1 lb. over the average of the flock before selection, will have a superiority of 1 x 70/100 = 0.7 lb. over the average of the unculled flock in subsequent shearings.

This is the basis for improvement of production in the current flock.

The scales will help to make the difference between those selected and the unculled flock as large as possible.

Future or Genetic Improvement.

Heritability measures the part of current improvement achieved by selection which is due to heredity and therefore will be passed on from parents to offspring.

The heritability of any character is given a numerical value according to the extent that it is passed on, any value of 0.3 or 30 per cent. or more being regarded as high.

Heritability of fleece weight in the Merino has been found to be 0.4 or 40 per cent. This means that by measuring production of parents, and using the superior animals, we can be certain that a big proportion of their superiority is being passed on to the offspring.

For example, parents selected with an average superiority of 1 lb. can, in general, be expected to have progeny with fleece weights 0.4 lb. above the average of the progeny from the unclassed flock.

This is genetic improvement from generation to generation and is the permanent improvement.

Since it takes about four years for one generation to replace the last the annual genetic improvement is only one quarter of this.

For instance, in the above example where we have an improvement of 0.4 lb. from one generation to the next, the annual genetic improvement would be 0.1 lb.

Thus the annual genetic improvement in the production of Merino flocks can be

Fig. 3.—Weighing the fleece after shearing.

Fig. 4.—Taking a sample from the raddled area. The sample is then labelled and forwarded to the fleece measurements laboratory.

quite small which further emphasises the need for accurate selection in the first place.

The scales will help you do this much more accurately than your eye.

FLEECE MEASUREMENT AND YOU

How many of you are thinking "Maybe this is so, but how does it affect me?"

Studs.

Under any system of selection the greatest scope for genetic improvement is in the studs. In selecting top rams there is much more chance to make the difference between the ones selected and the average before selection quite large. One ram can influence 50 offspring per year so that such genetic improvement can be first passed on to the rest of the stud and eventually to commercial flocks buying rams from this stud. While the stud continues to progress so do commercial flocks buying rams from it. By making accurate measurements of all factors which contribute to quantity and quality of wool produced the studmaster can gauge his progress.

While a full scale system of measurements is preferable to determine that progress is in the right direction, this need not be applied over all the sheep in the stud. Only the top ram-breeding nucleus need be measured. Advances in this group are then rapidly passed on to the rest of the stud which breeds sale rams and then to the commercial flocks.

To the stud-master, fleece measurement is a useful tool. It will enable him to select more accurately, make progress and continue to progress while he uses the best producers.

Also, as the production of parents can be directly measured and fleece weight in the Merino is highly heritable, studmasters can be confident that in using the best producing parents they are progressing genetically. The time-consuming and expensive progeny test loses many of its advantages, although it will still be useful in comparing rams raised in different environments.

Commercial Flocks.

Full-scale measurements in commercial flocks are hardly warranted. Usually the scope for selection on fleece weight is so small that any genetic advances resulting are of little economic significance.

Genetic advances, however, can be **bought** via rams from studs which are progressing.

However, basing selection of ewes on a simple system of Greasy Fleece Weight can do much to increase the current production of the ewe flock. The advances achieved may only be small per head, but when spread over a large flock they amount to a considerably quantity of wool. Such advances being highly repeatable are carried on over the lifetime of the selected ewes.

LAMBING PERCENTAGE

Throughout, we have been considering production as the amount of wool of a specified type that sheep produce. Another important factor in production is the number of lambs raised.

High lambing percentage gives you the chance to select more heavily and thus increase the rate at which the average immediate production of the flock progresses.

Lambing percentages warrant attention.

SUMMARY

1. To evaluate the worth of a sheep as a producer and breeder. Fleece measurement uses directly measurable characters, G.F.W., C.W.W., fibre diameter, staple length, crimps to the inch.

2. It is used in conjunction with other methods of classing and gives greater accuracy to selection.

3. It will be most useful when used in studs, as rams can be selected intensively and can more rapidly pass on genetic improvement to flocks.

4. Only animals of the same age and raised in the same environment should be compared.

5. Fleece measurement fits in with normal management and if used in conjunction with present methods of classing can double the present rate of breeding improvement.

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Do you know that the Department of Agriculture provides a comprehensive service of advice and technical assistance to farmers, free of charge?

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Extract from "The West Australian" on 21st June, 1956.

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HANDLING SALT LAND

MANY bare saline areas can be converted into useful grazing land. Careful land management is the key to salt land reclamation and very few saline areas will not respond to some form of management.

By

S. T. SMITH, B.Sc. (Agric.),
Senior Soil Research Officer

In reclamation the main aim is to provide a plant cover. This is done by—

(1) The control of grazing;
(2) soil cultivation; and
(3) by introducing salt tolerant plants.

CONTROL OF GRAZING

Wherever possible saline areas should be fenced off in such a way that grazing can be controlled at will. The control of grazing is the **most important single factor** in the reclamation of all salt-affected land. According to the severity of encroachment, the control necessary will vary from a slight reduction in grazing to the total elimination of grazing for several years.

ROUGHEN THE SURFACE

The surface of the soil should be maintained in a roughened state. This is important for two reasons. Firstly, the roughened surface traps blowing seeds which would otherwise be swept off the bare salt patches. Secondly, the cultivation causes water from rainfall to collect in small cultivation furrows, forcing it to

Fig. 1.—The value of cultivation and sowing of Wimmera ryegrass and barley on salt-pitted areas is demonstrated on the left.

Fig. 2.—Overgrazing on the left has eaten out the cover and caused the surface to become bare and salty.

enter and leach salt from the surface. In so doing, localised areas from which the salt has been washed, are formed. These are favourable to germination.

Deep cultivation is not necessary. A rough surface is the essential aim; it should be as permanent as possible. The method of obtaining this is of lesser importance.

INTRODUCE SALT-TOLERANT PLANTS

In salt-affected areas, salt accumulates in the soil particularly at the surface. The salts concentrate the soil solution and make it difficult for ordinary plants to obtain water for their growth. Salt-tolerant plants, however, have special ability to extract water from saline soils and will grow where other plants die. Furthermore, as the main concentration of salt is in the surface layers it is often difficult to get seeds to germinate in saline soils. Annual plants meet this difficulty every year and unless a very salt-tolerant plant is used, or the season is particularly favourable, germination is frequently delayed or prevented. Perennial plants do not require to germinate every year, and once established, are not quite so dependent upon favourable seasons. For this reason perennial plants are more suited to salt land. Of the salt-tolerant perennials at present available, trailing saltbush and bluebush show the most promise.

Among the annuals we have very salt-tolerant native plants such as spergularia, barley grass and curly ryegrass, all of which colonise rapidly on saline soil under protection from grazing. Annuals of moderate salt tolerance for which seed may be readily purchased include Wimmera rye grass, barley, oats and cereal rye.

WHAT TO DO WITH YOUR SALT LAND

Within the wheatbelt salt land may be affected to varying degrees and the method of handling it is dependent upon the severity of encroachment. Here are some examples.

Slightly salt-affected soils with perhaps 30 per cent. bare soil in small patches should be cultivated and sown with a cereal and Wimmera ryegrass. Grazing should be limited, and subsequent renovation of the soil with an implement such as a scarifier should be undertaken every year or two. This renovation stimulates the Wimmera ryegrass and aids colonisation of the bare patches. Cultivation should aim at stimulating existing plants without killing them; in some cases this may necessitate working before seeds have germinated.

On severely salt-affected areas, but not completely bare, the grazing should be eliminated for two to three years. During this time the surface should be kept

Fig. 3.—This line of bluebush plants resulted from blowing seed being trapped in a furrow on a salty area.

in a roughened condition so that it can become colonised by the naturally occurring salt-tolerant plants such as spergularia, curly ryegrass, barley grass, salt and blue bushes. Any covering of straw and litter on bare areas will assist reclamation.

On almost totally bare, very severely salt-affected soils, wind erosion is apt to become severe. Grazing animals should be eliminated until the area has been stabilised. The area should be furrowed in the spring on a checkerboard pattern with an implement such as a single-furrow plough, a grader-ditcher, or old mouldboard using one arm. Furrows should be no more than ten yards apart. This will reduce the wind velocity at the ground surface. The furrows will begin to colonise with salt-tolerant seeds. If reclamation is promising, additional working can later be given.

Areas wet with seepage water during the summer months suit the very salt-tolerant summer-growing grass *Paspalum vaginatum*. Under these conditions winter growing plants such as Wimmera ryegrass, mangels, spergularia and early Wimmera ryegrass will also do well.

Bare salt land is an eyesore and a liability. With careful management it may be converted into useful grazing land. This conversion may be achieved by fencing to control grazing, surface roughening and seeding with salt tolerant plants. Previously bare erodable areas can be converted into covered areas carrying useful fodder.

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Seven Factors In Profitable Poultry Farming

From a Broadcast Talk
by
D. K. GILES, B.Sc. (Agric.),
Acting Officer in Charge,
Poultry Branch.

Fig. 1.—Layers housed in a well-constructed shed with dry friable litter have a good chance of avoiding serious diseases.

PROFITABLE poultry farming depends upon getting the greatest number of eggs from the birds by good breeding and management, and carrying enough birds to give a reasonable income.

Of the many factors which influence the successful operation of a poultry farm, the seven listed below are of outstanding importance:—

Good breeding.
Good feeding.
Disease control.
Labour efficiency.
Clean, high quality eggs.
Size of farm.
Insurance against price fluctuations.

Breeding.

The first of these, good breeding, is at a low ebb in Western Australia. The C.S.I.R.O. Poultry Research Centre in Victoria has done some excellent work in finding simple, but effective methods of breeding. In the near future they will be publishing a report on a breeding programme which requires a minimum amount of labour, but at the same time gives an effective increase in egg production. We can look forward to more high quality birds coming on to the market when these breeding systems are put into practice. The Random Sample Test in association with private breeding programmes will show the farmer where the profitable birds are to be found.

Feeding.

Good feeding is the next important factor. In the last two years, our Research Station has obtained results which will permit us to produce more eggs for less food. The rations which are being recommended by the Department can save a third or more of the food used previously. This means an extra profit of something like £300 a year per 1,000 layers, without any more work. It can be seen from this, that it pays to feed efficient rations.

Disease Control.

Disease control is another factor. Good sanitation and treating disease when it is first identified are the most effective methods of reducing losses. In recent years,

Fig. 2.—Preventive medicines and vaccines reduce mortalities from poultry diseases.

it has been very rare indeed to see high mortalities due to disease, but there is still room for improvement however, by attention to sanitation.

Good sanitation is a feature of modern farm layout and there is a wealth of evidence to show that some of the diseases that have not been identified previously are due to insanitary conditions. Infectious blood poisoning is an example of this. Further to this, dirty yards and litter mean dirty feet and soiled eggs in the nest. Nobody wants to eat eggs if the shells are soiled with poultry droppings.

Labour Costs.

Labour efficiency is a factor which has been receiving a good real of attention in the last few years. It is now realised that to carry enough birds to provide a satisfactory living for a family, more birds have to be carried per man without reducing the rate of lay The two factors which have contributed most to this, are improved farm layout and mechanisation.

Modern farm layout cuts travelling time to a minimum, and has reduced the time and labour once spent on many of the routine jobs such as watering, feeding, and temperature control of brooders. Mechanisation has saved time still further by enabling the farmer to mix his feed in bulk.

On many farms, many more birds can be carried per man, but a debit against this is the increased number of eggs that have to be cleaned. Packing large numbers of eggs is less arduous if they are clean, therefore, clean litter and clean yards are essential if the eggs are to be taken from the nest ready for packing without cleaning.

Egg Quality.

This brings us to our next point, the marketing of good quality eggs. Good quality eggs must be clean and the air cell must not be deeper than ⅛in. when they are graded. It is highly important that eggs should never be stored in

Fig. 3.—Birds reared on fresh green pastures have a good opportunity of developing into healthy profitable layers.

draughts or at temperatures greater than 60°F. This is particularly important in summer. Air conditioning or air coolers can be highly effective, providing that at no time is there free water on the egg shells. If eggs are not graded first quality then the price received is less than the cost of production, so that they are uneconomic to the farmer. Further to this, the farmer can improve his own market if eggs are clean and fresh.

Farm Sizes.

All the preceding factors are necessary to give high production per bird, labour efficiency and the marketing of good quality products, but the farmer must still sell sufficient of his product to make a decent living. At present prices, he can net something like 15s. a bird over all costs except labour. If he is only carrying 1,000 birds his total income is £750. If however, he carries 2,500 he can net something like

Fig. 4.—By feeding tested rations recommended by the Poultry Research Station the farmer can increase his income by £300 per 1,000 layers annually.

£2,000. This is a bit more than 15s. a bird, but it must be remembered that the larger farmer can cut his overheads.

Because lack of capital often prevents a farmer from building just what he wants in the first place, he runs the risk of ending up with a mass of scattered small sheds which do not come up to the minimum requirements for efficient poultry husbandry. It is highly important therefore, that the farmer should build to an overall plan. When one sees large laying sheds,

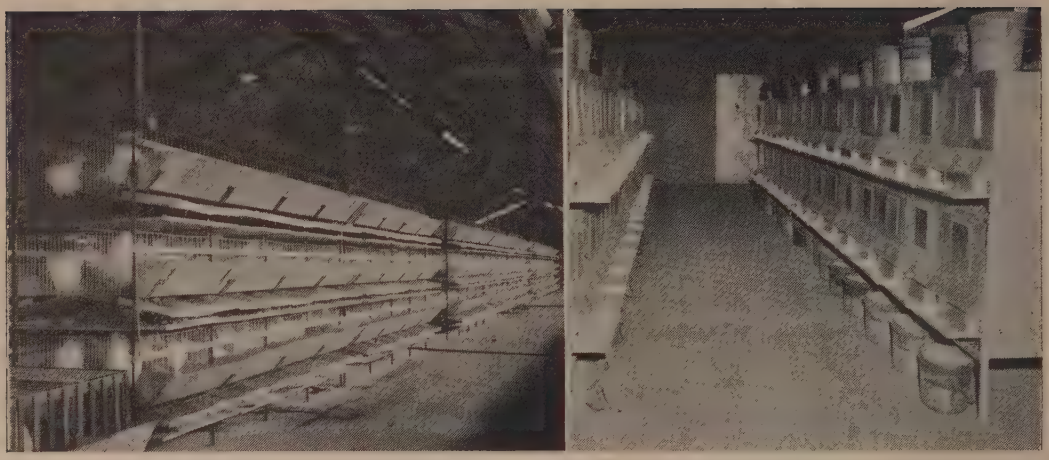


Fig. 5.—Equipment like this, now in use at the Poultry Research Station, has helped us to cut feed costs for egg and poultry meat by one-third and one-half, respectively.

150ft. to 200ft. long and 30ft. wide, they appear to be impossible to build with a small amount of capital. There are many sheds in the industry today however, like this which have been built by adding a little bit each year.

Price Fluctuations.

Once a farmer is producing, his biggest hazard is fluctuating prices. The egg and poultry meat market is renowned the whole world over for the big variations in prices from year to year, and it must be remembered that it is only the last few pence on the wholesale price of eggs that give the profit.

For instance a drop in price of 3d. a dozen—say from 4s. 6d. to 4s. 3d.—means a reduction of only one-eighteenth, or less than 6 per cent. of the poultry farmers gross receipts—which may not seem a serious matter.

Most of the gross return however is swallowed up by cost of food, labour, maintenance of plant and other overheads so that the farmer is to a large extent merely recouping himself for money already spent.

His real income consists of his net profit—which might be 1s. a dozen when eggs are bringing 4s. 6d. Under such conditions a drop of 3d. a dozen in wholesale prices takes one-quarter or 25 per cent. of his income—which is a serious reduction.

Obviously therefore the poultry farmer must operate on a long-term basis—in other words he must be in a position to put aside sufficient reserves during the high-price periods to be able to maintain his income at a reasonable level during those recurring periods when low prices reduce his profit margin.

Always remember that successful poultry farming is a matter of mass-producing a product with a small and fluctuating margin of profit per unit. If this is made the basic principle of the farmer's operations there is no reason why an efficiently-conducted poultry farm should not be as prosperous as any other soundly-operated industry.

MYXOMATOSIS

Its Progress and Future in W.A.

By A. R. TOMLINSON, Chief Vermin Control Officer

FEW people would have believed in 1951, that the huge rabbit population of Western Australia—estimated at over 50 millions—would have been reduced to the present low numbers. It was in 1951, that the Director of Agriculture, Mr. Baron Hay, arranged for some myxomatosis virus to be made available to Western Australia. The Veterinary Branch of the Department obtained a small supply, and in conjunction with the Agriculture Protection Board and Government Entomologist carried out initial trials. These were at Muresk, and on Mr. D. E. Ludeman's property at Bejoording where a low-grade infection was started.

Centres were established at various places where endeavours were made to start spreads, and where farmers could have rabbits infected. Owing to the limited supplies of virus available from the Eastern States, the number of centres was necessarily limited, but 13 had been established by the end of 1951.

A photograph taken in 1951 when the first attempts were made to start "spreads" at Muresk and Bejoording. Clippers were used to remove fur from an infected rabbit in order to encourage spread of the infection by mosquitoes

Immediate success was obtained in Beverley and Gnowangerup where relatively small spreads occurred, and at Geraldton where the spread was 80 miles long by 20 miles wide.

In 1952, the Commonwealth Serum Laboratories, mainly at the request of this State, commenced to prepare sufficiently large quantities of the virus for sale in ampoules, and since then supplies of ampoules have been available to farmers.

The Agriculture Protection Board persisted in its efforts to seed the disease over as much of the rabbit infested areas as possible—to an extent which far exceeded similar work in the Eastern States.

The Board, with the farmers and Vermin Boards who co-operated, has been well rewarded. All this groundwork resulted in increasing low-grade infections over large areas. Then there was the big spread in the Avon Valley in 1955, and this season myxomatosis has extended over most of the agricultural areas. The disease, coupled with the Protection Board's "1080" rabbit control scheme, and other control work has brought rabbits to their lowest level in this State within the memory of most farmers.

But what of the future? Despite the huge coverage obtained there were many pockets left untouched or only partly affected. We know only too well what this means. Within a year or two, these pockets could quickly repopulate the cleared areas.

Then there are the residual populations left after the successful outbreaks. Possibly only a few have been left on each property, but in theory two rabbits can increase to 13 millions in three years. In practice they may not be as prolific as that, but they will do their best, and will increase to many thousands.

We are several years behind the Eastern States in our spreads, and we now know the pattern which the disease is following there and will be followed here. In progressing from rabbit to rabbit the disease changes and in some instances becomes so weakened that it only immunises rabbits against the more virulent strains, so that they are protected, as human beings are protected from some diseases by vaccines.

Fortunately, this immunity from myxomatosis is not transmitted to the progeny. However, another factor has already become apparent. A hereditarily resistant strain of rabbits is slowly being built up. In other words, a course which was anticipated is now being followed. There are some rabbits—not many—which are naturally resistant and even immune to the disease, and they are slowly building up.

The scientists predict that in five to ten years myxomatosis will have lost most of its effectiveness by the increase in this immune strain.

However, between the present and this future stage we have a great opportunity to keep rabbits well under control, by maintaining normal control work such as warren destruction and poisoning. It is felt that these measures, together with the constant release of the original strain of virus, will also postpone the inevitable build-up in immunity.

The important things to do therefore, are:—

(1) To destroy all warrens whether they appear to be populated or not.

(2) To continue poisoning wherever there are any signs of rabbits.

(3) To continue with inoculations from fresh ampoules—and remember, warren destruction and poisoning will not materially interfere with myxomatosis when it is spreading.

(From an A.B.C. Country Hour talk. By courtesy of the Australian Broadcasting Commission).

WHEAT QUALITY SURVEY

The Minister for Agriculture (Mr. E. K. Hoar), recently announced his approval of a proposal to institute a wheat quality survey in this State. In the coming harvest the work would include analyses of protein percentage and protein quality on the average samples collected for the annual f.a.q. determination from over 280 bulk handling receival sidings. In addition a more intensive study would be made of the individual deliveries at four or five selected sidings.

The first set of data would indicate the average quality which would be expected from any siding or district. The second series would be more of an exploratory nature to indicate the range of quality at any one siding and would be preliminary to the development of a suitable sampling technique for future years.

Mr. Hoar emphasised that during recent years there had been a number of changes in the pattern of wheat production in this State, such as the marked increase in production from new light land and the development of ley farming on clover pastures. These influences would affect the quality of the wheat being produced both between and within districts and it was highly desirable that a survey of the quality of the State's wheat should be undertaken. Information based on factual data was essential in order that sound consideration could be given to such questions as the supply of the requirements of the local trades for bread and biscuit making as well as the possibility of segregation for export on a grade basis.

Co-operative Bulk Handling Ltd. was keen that such a survey be instituted, said Mr. Hoar, and he was very grateful for their ready acquiescence to his request for assistance in the collection of the samples. The analyses would be carried out at the Government Chemical Laboratories and the cereal laboratory in the Department of Agriculture.

KIKUYU GRASS

(Pennisetum Clandestinum)

By F. E. RYAN, B.Sc. (Agric.), Agrostologist

MANY dairy farms in the South-West of this State have a small patch of kikuyu grass. It grows in the vicinity of the milking shed and is used to prevent erosion due to the heavy trampling of stock. Under these conditions, it forms a firm, close sod providing a green bite, but not very much bulk.

At the farm house it may be used to provide a fine lawn but more often it is found growing rankly in flower beds and around the house and out-buildings on the farm. Here it is merely a nuisance and because of this has been frowned upon by some farmers as a pasture plant. It is however, a most valuable plant as a pasture species when grown in the paddock.

Kikuyu was first recorded in Western Australia about 35 years ago and has spread since then until today, it is fairly well known throughout dairy farms in the South-West.

GROWTH HABIT

This grass is a perennial and spreads by means of stolons on the surface of the soil and by rhyzomes underground. The underground rhyzomes are only developed in friable soils and reach their maximum development in sandy soils where they may reach down to a depth of two to three feet beneath the surface of the soil. The plant is deep-rooting and is able to tap lower levels of the soil for moisture and plant nutrients.

By reason of its vigorous creeping stems, it rapidly forms a mat on the surface of the soil where it is very resistant to grazing. In its native habitat in Africa, it makes spring and summer growth but has adapted itself very well to conditions in Western Australia. Here it is capable of late spring, summer and early autumn production.

SEED PRODUCTION

For many years this grass was considered incapable of forming seed under our conditions but in recent years, seed production has been observed in many stands throughout the South-West including the lower South. Seedling plants have also been observed in new areas where the seeds have been carried by stock. A seed-producing strain was obtained from the Waite Institute some years ago in an attempt to produce commercially available seed of this valuable pasture plant. Unfortunately it has not been possible to produce and harvest sufficient seed to make seed production a commercial proposition and it is necessary when sowing kikuyu to do so from roots and runners.

PROPAGATION

Propagation is by vegetative means. This is done by laying roots in furrows and covering over with soil, leaving some leaf material protruding. It is sometimes done by ploughing furrows across a paddock at a distance of three or four feet apart, dropping roots in the furrow and then filling in the furrow. A suitable implement to use is a single-furrow plough. Plough the furrow with one run, place the roots in the furrow and then heel them in with the wheel of the tractor when ploughing the next furrow. Where a mouldboard plough is used, it is possible to plant closely in each furrow and cover it when the next furrow is turned.

Several other alternatives exist. On sandy soils it is possible to spread a layer of fresh roots from the back of a truck or utility and rotary hoe these in to a depth of three or four inches. A number of sections will die out but many will succeed in taking root. Kikuyu can be planted between the rows of a maize crop on summer-moist soil. It will not establish itself and grow rapidly enough to interfere with the maize crop but when the maize crop has been removed, the kikuyu will be established firmly.

Where roots are planted by any of these means, grazing on the paddock should be avoided for some considerable time as the stock tend to pull the roots out of the ground if they are grazed too soon after planting.

SPRIG PLANTER

A machine known as a Bermuda sprig-planter which plants sprigs of kikuyu has been demonstrated in the Denmark-Walpole area. The supply of kikuyu roots is obtained by rotary hoeing and raking. These fresh roots are placed in a hopper on the implement and are moved to a planting chute as they are teased out by means of "walkers."

The implement opens up two furrows spaced three to four feet apart, plants the kikuyu root in the furrow, fertilises it, fills the furrow with soil and presses the soil in position. In operation this machine has worked very satisfactorily on previously cultivated land but results from these plantings will not be known until next summer when the degree of establishment can be determined.

RENOVATION

This operation is essential if high production is to be obtained from kikuyu. To be most successful, a kikuyu sward should not be allowed to become sod-bound. A rigid-tyne cultivator or a similar implement fitted with fine "tickler" points may be used and renovation should be carried out every two or three years before the sward is allowed to become sod-bound. A combine has been successfully used for this purpose. Some of the points were removed and the combine drawn through the kikuyu in two directions. This operation was carried out during March-April period. On one property at Margaret River, as a result of this operation, subterranean clover and ryegrass grew very strongly on the kikuyu patch and was cut to yield 3½ tons of hay per acre which consisted of an excellent mixture of ryegrass and subterranean clover. When the hay was removed in the spring, the kikuyu made excellent growth and carried a large number of stock for several months.

After a paddock of kikuyu has been allowed to become sod-bound more drastic treatment may be necessary to open up the pasture. A combine with some of the points removed has been used for this purpose but a powerful tractor is necessary to pull the implement through the kikuyu. A rotary hoe working to a depth of two inches may be used to break the surface mat of roots and stems in a sod-bound kikuyu stand. Following this rotary hoeing a tyne implement such as a rigid-tyne scarifier, a semi-rigid-tyne scarifier or a combine could be pulled through the paddock to a depth of four or five inches.

These operations should take place in the autumn in March, April or May. If it is considered necessary, the renovated area could be over-sown with subterranean clover and Wimmera ryegrass following this renovation.

It is better however, not to allow the stand to become sod-bound, but to commence renovations in the second year after establishment and before the operation has become too difficult.

NUTRITIVE VALUE

Kikuyu is found to be very palatable to all classes of animals, including cows, horses, sheep and even poultry. In a young leaf stage, it is highly nutritious but if allowed to grow tall and rank its nutritive value declines rapidly. Young leaf samples taken from a sward at Margaret River gave the following analyses to compare kikuyu with subterranean clover.

Thus, in the young leaf stages, kikuyu is as nutritious as clover or even lucerne hay. Analysis was made of a sample of hay cut from a pure kikuyu stand. The

Analysis of Dry Matter.

	Subterranean Clover.				Kikuyu.			
	July.	Aug.	Oct.	Nov.	July.	Aug.	Oct.	Nov.
Nitrogen, per cent.	3·46	3·69	3·55	2·72	2·35	2·57	2·89	2·78
Protein, per cent.	21·62	22·96	22·19	17·00	14·69	16·10	18·06	17·37
Phosphorus, per cent.	·338	·301	·279	·276	·375	·397	·363	·333
Potassium, per cent.	1·20	1·49	1·40	1·37	2·41	2·80	3·74	3·10
Copper, p.p.m.	18·0	15·25	13·5	12·75	9·25	9·9	10·5	16·45

protein content of the hay was 4 per cent. which was no better than an average sample of oaten hay and lower than most oaten or meadows hays. Kikuyu then should never be allowed to make rank growth.

VALUE AS A PASTURE PLANT

One of the most important aspects of kikuyu as a pasture plant is its ability to produce vigorously at periods of the year when annual pastures are normally unproductive. After subterranean clover and ryegrass pastures decline in the late spring, kikuyu commences vigorous growth. When the spring growth of the annual species is over, the kikuyu paddocks will be carrying a bulk of forage and if moisture relationships are suitable will continue to do so during the summer months.

During the autumn and immediately following any autumn rains, kikuyu makes vigorous growth. At this time of the year, annual plants are germinating as seedlings and are not in a suitable state for grazing, nor do they produce any great quantity of feed, consequently the value of kikuyu at this time of the year cannot be over-estimated.

On sandy soils, kikuyu has proved very suitable. These soils dry out very rapidly if not protected by a surface cover and this is most effectively done by means of kikuyu. Establishment of the kikuyu on such situations is slow and the planting of sods rather than roots is recommended.

Around cowyards, along raceways and even in gateways, the only plant capable of withstanding heavy trampling from the stock is kikuyu. It becomes sod-bound and is not highly productive but even so is the best grass available for such a situation.

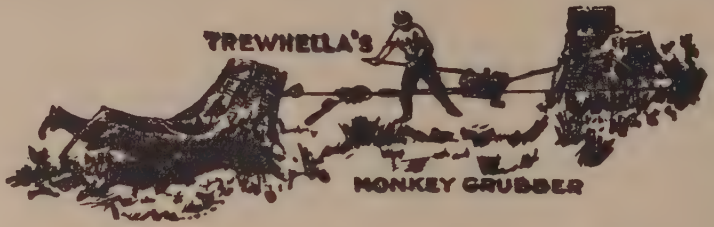
"MILK AND BUTTERFAT RECORDING: A WORLD SURVEY"

By E. D. ASHTON, B.Sc. (Milk Marketing Board, England)

This is the first book published for 21 years surveying the systems used in different countries for recording the production of milk and butterfat of the world's dairy cows. During this period great changes and developments have occurred. The author is the Head of the Bureau of Records at the Milk Marketing Board in England and therefore in a unique position to survey, compare and contrast the different methods used not only in Britain, but also in other countries.

The book is divided into two main parts, the first dealing with the historical development of milk recording and butterfat testing, the organisation of societies and associations, their financing and the use of records by various interested bodies such as herd book societies, artificial insemination centres and research workers. The second and larger part gives in considerable detail the growth and organisation of recording societies in a large number of countries. Throughout the book there are some 88 tables giving details of numbers of cows, yields, butterfat tests, etc., as well as a number of appendices. Photographs illustrate the technique of milk recording and butterfat testing under widely differing conditions from Iceland to Australia.

(Commonwealth Bureau of Dairy Science and Technology, Technical Communication No. 3. (224 pages including 88 tables.) Obtainable from the C.A.B. Liaison Officer at 314 Albert Street, East Melbourne, C.2, Victoria. Price, 37s. 6d.).



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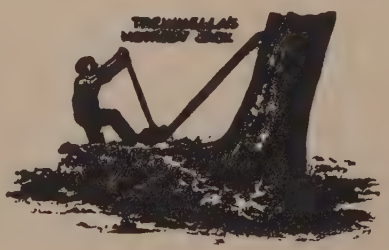

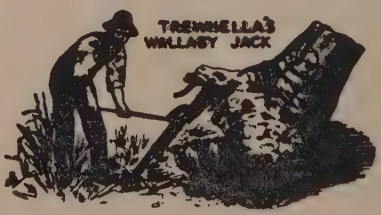

WARTS ON CATTLE

By

OFFICERS OF THE VETERINARY BRANCH

A Jersey bull carrying large numbers of warts on the head and neck

PAPILLOMA or warts are by no means uncommon in dairy cattle in Western Australia. In maturing cows, they usually occur on the udder, while in young stock they may be found on the head, neck, and shoulders. In bad cases, a large proportion of the body area may be covered with the warts, forming large cauliflower-like masses which often bleed easily.

The condition is caused by a filterable virus, and animals may be affected through rubbing on affected animals, or by being placed where affected animals have been. Badly affected animals do not thrive, while the warty condition seriously depreciates the value of the hide.

Warts on the teats are infectious and may be transmitted from cow to cow on the hands of the milker. These warts are of many shapes and sizes, and may cover all the teats of the udder. Long slender warts are easily removed with scissors or by tying a silk ligature tightly around their base so that they will slough off in a few days. The roots of such warts should then be treated with caustic potash sticks.

TREATMENT

Flat warts, which may cover almost the entire udder surface, are sometimes extremely difficult to deal with, and treatment should not be attempted until the cow is dry. Careful perseverance with treatment is necessary. Application of glacial acetic acid on the end of a matchstick, repeated over a number of days may cause the disappearance of the warts. Salicylic acid (one part), collodion (seven parts) may be painted on once per day with good effect. Salicylic acid (one part), glycerine (three parts) is also used. The use of a silver nitrate stick or caustic potash stick is more efficient, but more dangerous. Similarly, commercial hydrochloric acide may be applied with caution to the exact area of the wart.

In the very early stages of wart formation, the daily application of crude castor oil has been known to check the development in some instances, although several weeks may elapse before a cure is effected. Olive oil smeared thickly over the area between milkings is also recommended.

The internal administration of Fowler's solution of arsenic, 1 tablespoon twice daily for stock 6-12 months old until symptoms of arsenical poisoning begin to appear, is claimed to have a beneficial

effect in some cases. A wart vaccine is in use in America, but no such procedure has been tried out as far as is known in this country.

A new method of treatment which, in some cases, has produced good results, is the injection of lithium antimony thiomalate (Anthiomaline, M and B).

This is administered either by subcutaneous (under the skin) or intramuscular (into the muscle) injections at a dose rate of 10 to 20 c.c. depending on the size of the animal. Injections should be given twice weekly to a total of five or six doses.

Slight side-effects, consisting of muscular stiffness, mild fever or depression, may occasionally be observed following the use of this drug, but they are only of a transient nature.

The action of the drug in the body causes some of the warts to fall off and loosens others so that they may easily be detached.

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ELECTRIC FENCES ON DAIRY FARMS

By

F. E. RYAN, B.Sc. (Agric.), Agrostologist

Fig. 1.—With strip grazing, Yorkshire Fog pastures are readily eaten by stock, as shown by this photograph taken at Manjimup.

DURING the last four or five years, a number of electric fences have been brought into use in the higher rainfall areas. These are playing a very important role in increasing production and almost without exception, improvement in output has been reported following their introduction. During 1954, ten sets were used for demonstration purposes throughout the dairying districts under the terms of the Commonwealth Dairy Extension Grant. These demonstrations have all been successful and leave little doubt as to the effectiveness of this type of grazing management.

The influence of strip grazing on production can be substantial. Farms which were operated on a rotational system of controlled grazing for many years have recorded increases in production of up to 30% following the introduction of the electric fence. Such an increase on highly-developed properties is phenomenal and suggests that on less well-developed properties, even greater usefulness can be found with the minimum of effort.

In 1953, on one property at Harvey, 54 cows in milk were maintained continuously on 25 acres of irrigated pasture from November until June—a period of eight months. These were high-producing cows and were not fed concentrates during this period. Pastures on the 25 acres grew too rapidly for the animals and during February, 11 acres of the irrigated pasture were cut for hay. Even with this high concentration of animals on the pasture, the time interval between grazing on each strip and the returning of animals to the same strip was six weeks. Such a level of production had never been recorded previously on this farm.

Strip grazing is primarily a refinement of rotational grazing in which stock are confined on very small areas for one grazing period. It is impractical to erect permanent fences to provide such small paddocks and the electric fence is undoubtedly the most convenient type of temporary fence.

It also has the advantage of being elastic so that smaller or larger strips may be provided according to the abundance of

the pasture, thus enabling grazing management to be fitted to great extremes of seasonal pasture growth.

In autumn and winter, pastures must be managed very carefully to utilize them to the maximum and at the same time, not excessively to the extent of preventing their growth and development. In the spring, grazing can be restricted to a reduced area to enable greater conservation in preparation for the summer, autumn and winter.

Strip or rotational grazing can assist in many ways and the demonstrations now being carried out show that the electric fence can help considerably in the following ways.

1. Utilisation of Herbage.

Experiments carried out in England showed that under a system of strip grazing, stock utilized a greater percentage of the herbage available to them than under a rotational system of grazing. In this work it was reported an increase of 25% in the amount of pasture eaten under a system of strip grazing as compared with that eaten under paddock grazing. To some extent this is borne out in the demonstrational work.

At Bridgetown, eight acres of early oats were strip grazed in July using an electric fence. It was estimated that the oats provided at least twice the amount of grazing that would normally be expected. 25 cows grazed on the eight acres for ten hours per day, the paddock providing grazing for them for 21 consecutive days. Three weeks later, the animals were again returned to this oat paddock and 32 cows were grazed for 14 days. They were fed some hay whilst grazing on the strip, but no other supplementary feed. Their production was never less than 1 lb of butter fat per cow per day during the period of grazing on the oats.

Experience with oats for grazing over a period of years has taught farmers what might be expected from free grazing of such a crop. Many have been surprised to find that twice as much grazing has been obtained as was expected. Observations have confirmed the view that with this grazing management much less material is trampled into the ground and a greater percentage of the crop is actually consumed. The production of butterfat of these animals was carefully watched to determine whether they were obtaining sufficient food but no reduction in yield was observed. It appears that the claim of greater utilization is therefore supported.

An extreme case of this was observed in an oat crop 2 ft 6 in. high which was strip grazed for one hour per day. There was practically no waste straw or leaf material trampled into the ground and all of the material within the strip was removed.

A similar result has been observed on pasture, and sceptical farmers have been very quickly converted to this type of management after a trial.

2. Increased Fodder Reserves.

The use of the fence during July and August and September on early oats and pastures has resulted in some demonstrations in the substantial saving of pasture. By confining stock to small strips in the winter and early spring, the proportion of the total area which is grazed by stock can be kept to a minimum. As a consequence, a much greater area is available for conservation as hay.

One farm at Manjimup which has been under examination for a number of years for better dairying competitions, used the electric fence for the first time in 1954. In that year this farmer was able to close up 30 acres out of a total 100 acres of his farm for conservation as hay. He carried 35 milking cows.

It would be possible to close up larger areas for hay or silage during the spring, if frequent paddock changes for the grazing animals were not necessary. This is possible when animals are confined to smaller areas by using the fence. In addition to this, better autumn and winter management of pastures results in more vigorous pastures and better spring growth. Electric fencing allows the seedling plants to become well established before they are grazed, and permits quick grazing followed by long intervals for recovery during the winter months. Greater quantities of silage and hay are therefore obtained.

Fig. 2.—An electric fence used for strip grazing on lucerne pasture.

Inadequate supplies of conserved fodder are the rule rather than the exception and in this way the fence can assist in increasing farm production.

3. Provision of Grazing During the Autumn and Early Winter.

On most dairy farms, this is the most critical period of the year. Pastures are low and of necessity are heavily grazed. Recovery following severe grazing of the early growth is slow and as a result of this early grazing, pasture production during the winter and early spring months is low. Severe grazing during the autumn may cause a reduction in spring growth.

Where strip grazing has been practised, stock are maintained on a much smaller area in the early autumn either on pasture or on early oats, the pasture areas which have been freed from grazing early in their life make vigorous growth during the winter and even if they are grazed at this time recover rapidly following grazing.

4. Provision of Grazing in the Summer Months.

Crops of Sudan grass and Japanese millet provide green fodder at the end of the normal pasture season. In suitable seasons these crops can provide green fodder for several months during the summer and even in a very dry summer such as was experienced in 1955-56, one month or six weeks extension of the normal grazing season could be obtained from such plantings. For the maximum use of such areas, an electric fence is necessary and the crops should be strip grazed.

On one farm at Balingup during 1955-56, six acres of Japanese millet provided grazing for 22 cows during January. These cows continued to milk, producing $\frac{3}{4}$ lb. of butterfat per cow per day, to the end of January, whereas 33 cows from the same herd which were not grazed on the millet declined rapidly in production and dried off before the end of January. These latter had adequate supplies of dry paddock feed while the 22 cows which continued in milk were permitted $2\frac{1}{2}$ hours grazing on the millet each day. This was sufficient to keep them in production for at least four weeks. The efficient grazing of such crops as Japanese millet or Sudan grass is possible only with the aid of an electric fence.

5. Weed Control.

Where cattle are grazed in small strips by means of the electric fence, they graze evenly and uniformly. Selective grazing is reduced to a minimum. Cows which were grazed in strips on pastures during the autumn ate capeweed as well as subterranean clover and grasses. Open paddock grazing carried out by the same animals resulted in their selectively grazing the subterranean clover and leaving the capeweed untouched.

Where the strip grazing had been practised, more vigorous growth of the subterranean clover and less competition from the capeweed has been noted.

6. Earlier Calving.

As a result of strip grazing, several farmers have realized that their early oats and pastures can be more efficiently used

if an electric fence is employed. Because of this, it has been found possible to calve down a month earlier than normally was the case. It has been pointed out from analyses of herd recording figures that March-April and May are satisfactory months for calving on farms producing butterfat. The earlier calving results in greater total butterfat per cow and per acre.

With the advent of the electric fence, it has been found possible on these farms to calve down at least one month earlier than normally would be the case.

7. Longer Lactations.

Earlier calving which can be arranged safely with the aid of the electric fence, the provision of greater quantities of hay from the farm and the ability to graze from summer fodder crops, enable dairymen to lengthen the lactation period of their cows, thus providing greater production per cow and per farm.

The electric fence and strip grazing can do much to increase production on dairy farms in Western Australia. On most farms, partial use only has been made of the fence and its application can be extended quite considerably in most cases. Where partial use has been made of it on individual farms for purposes such as grazing early oats, early winter and spring grazing of pastures, grazing irrigated pastures during the summer months and for rationing of summer crops, improvement in carrying capacity and production has been reported and farmers using the fence have become very enthusiastic. It is sufficient to record that many of the neighbouring farmers, hearing of the results of these demonstrations have now purchased fences of their own.

Apart from controlled rationed grazing in strips the fence will be found to have many subsidiary uses on the farm. These may be listed as follows:—

(a) A temporary internal division fence on large paddocks.
(b) Fencing of crops or newly sown pasture areas which are not permanently fenced.
(c) Protecting hay and silage stacks.
(d) Providing a self-feeding system for a silage stack or clamp.
(e) As a temporary stock yard or for stock-proofing bull paddocks.
(f) Protecting young shelter belts, dams, dairy buildings and drains.
(g) Protecting irrigation spray lines, channels and drains.
(h) For sub-division and rotational grazing of calves and segregating calves into groups.
(i) For fencing off sand drift areas until adequate plant cover has been obtained.
(j) For temporary raceways.

Acknowledgments.

Information from demonstrations with the electric fence has been obtained from field officers of the Dairy Division to whom acknowledgment is due.

RESTRICTIONS ON THE IMPORTATION OF CANNED MEATS

No canned meats may be imported into Australia from countries other than New Zealand unless they are accompanied by a certificate to the effect that the contents of the cans were subjected during the course of manufacture, to a temperature of not less than 100° C. and details as to the temperature employed and the time of exposure to it are required to be furnished.

While compliance with these requirements should present no difficulty in the case of commercial consignments, it is unlikely that parcels forwarded by post will be accompanied by the prescribed certificates, and persons who are accustomed to receive gifts of canned meat or poultry by parcel post from friends overseas would be well advised to notify the senders so as to avoid loss or disappointment.

Uncertified parcels will be intercepted by quarantine officers and, unless re-exported, will have to be destroyed.

Further particulars may be obtained from Chief Quarantine Officer (Animals), Department of Agriculture, Perth.

In explanation of the new regulations which have been gazetted under the Commonwealth Quarantine Act, the Chief Quarantine Officer (Mr. C. R. Toop), said that until recently, canned meats could be imported to Australia from any part of the world without restriction. Inquiries, however, have now revealed that some of these products are not effectively sterilised by heat treatment during the process of manufacture, and that they may constitute a disease risk.

THE CYSTIC TAPEWORMS
(BLADDER-WORMS)
OF SHEEP

By

C. R. TOOP, B.V.Sc.,
Chief Veterinary Surgeon

WHEN sheep are examined at post-mortem, bladder-like structures or cysts containing a clear watery fluid may frequently be observed in the body cavity and in various tissues and organs. These are tapeworm cysts and represent larval or immature forms of tapeworms, the adult form of which is found in the intestine of the dog and other closely allied animals.

Three kinds of tapeworm cysts are found in sheep in Western Australia. Two of these are *Cysticerci* in which the cyst contains a single tapeworm head. The third is the *Echinococcus* or hydatid cyst which contains numerous tapeworm heads and frequently grows to a large size. These cysts rarely affect the general health of the sheep and their presence is detected only when the animal is subjected to post-mortem examination. Two of them, however, are of considerable importance. *Cysticercus ovis* is responsible for the condition known as "sheep measles" and causes the rejection of lamb and sometimes mutton carcases intended for export. The *Echinococcus* or hydatid cyst not only occurs in sheep but affects other animals and man, constituting a danger to human health.

The sheep become infected by swallowing tapeworm eggs passed out by infected dogs which contaminate the pastures. The dog in turn becomes infected from the consumption of raw offal containing tapeworm cysts. For the control of the parasite it is necessary to break this cycle firstly by the treatment of dogs for the removal of the adult tapeworms and secondly by the adoption of precautions which will prevent the dog from obtaining access to raw offal.

CYSTICERCUS OVIS—"SHEEP MEASLES"

Cysticercus ovis occurs principally in the heart muscle and diaphragm where the cysts may be present in large numbers. They may also be observed in various locations in the muscular system and in the tongue as well as in the walls of the oesophagus (gullet) and stomach. The cysts are oval in outline and measure about a third of an inch in length by a sixth of an inch in breadth, the tapeworm head being situated about midway between the ends. *C. ovis* occurs predominantly in lambs. The cysts undergo rapid regeneration and are much less frequently observed in adult sheep. From the appearance of the tissues in which the cysts are located, the condition is sometimes referred to as "sheep measles."

C. ovis is of considerable importance to the export lamb industry. Carcases showing evidence of infection, are rejected as unsuitable for export, and are sold on the local market, usually at a reduced figure, and with consequent loss to the producer. The incidence of *C. ovis* infection in lambs varies considerably from season to season but records which have been kept at meat export works over a number of years, indicate the average annual rejections from this cause to be in the vicinity of 0.25 per cent.

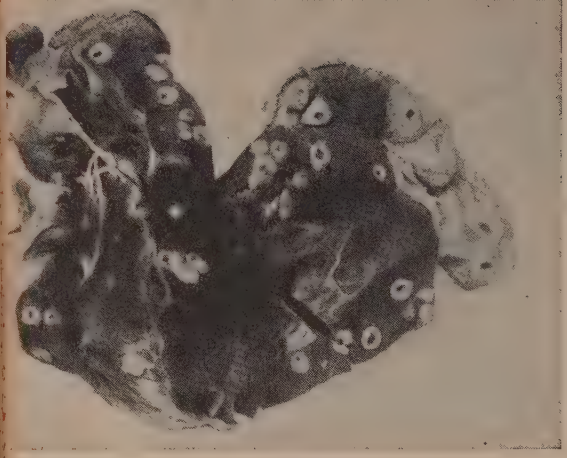

Fig. 1—*Cysticercus ovis* in the heart muscle of a sheep. (After Drabble.)

It may be mentioned that the parasite is not transmissible to man and that the presence of cysts in lamb carcases is of no importance in relation to human health.

LIFE HISTORY

The adult tapeworm is known as *Taenia ovis*. It occurs in the intestine of the dog and allied species such as the fox and dingo, and varies in length from about 18in to 5ft. Like other tapeworms the parasite is flat and ribbonlike and consists of a head and neck and a chain of segments. The head is small and provided with suckers and hooks which enable the parasite to attach itself to the lining membrane of the bowel. The segments are rectangular and increase in size from the head backwards. As the segments mature or ripen they become detached and are replaced by new segments which form behind the neck. The ripe segments contain tapeworm eggs which are passed out in the droppings and contaminate the pastures over which they may be distributed by the action of wind and rain. The tapeworm eggs are swallowed by sheep while grazing and upon reaching the intestine, the shell is digested and a minute embryo armed with six hooks is liberated. The embryo bores through the bowel wall and gains access to the blood vessels, being carried to the liver and then to the heart. From this point it passes into the general circulation and is carried to locations such as the heart muscle and diaphragm, in which it is detected at postmortem. Here the embryo continues to grow, developing into a mature tapeworm cyst after an interval of two to three months. The dog becomes infected by eating raw offal, e.g., the heart, containing tapeworm cysts, and upon reaching the intestine the bladder is digested setting free the tapeworm head which becomes attached to the bowel wall. After an interval of about two months, a chain of segments is developed and eggs commence to be voided in the droppings. This completes the life cycle of the parasite. The life histories of *Cysticercus tenuicollis* and *Echinococcus granulosus* are similar.

Control.

Since sheep become infected by the ingestion of tapeworm eggs voided by dogs, control measures should be directed towards the prevention of infection of dogs together with treatment for the removal of the adult tapeworm.

In order to prevent infection, dogs should never be fed on, or allowed access to raw offal, but this material may safely be used after boiling for 10 minutes which will destroy the tapeworm cysts. In addition all dogs on sheep-raising properties should be regularly treated with drugs for the removal of tapeworms. Arecoline hydrobromide is highly effective for this purpose, and it may be procured in the form of ½ grain tablets. This is the dose for a sheep dog of average size and it may be given either in tablet form or in solution after the tablet has been dissolved in a fluid ounce of water. In smaller dogs such as terriers, the dose should be reduced to ¼ grain while in the case of kangaroo dogs and animals of similar size, a dose of one grain may be administered. Treatment should be repeated at intervals of six months.

Since the fox, dingo and feral dog (domesticated dog gone wild), may also harbour the tapeworm, the control measures outlined above must be advocated with a good deal of reservation. A survey carried out in Victoria some years ago showed that foxes may harbour the adult tape-worms in considerable numbers. Although this survey was confined to a limited number of animals, it indicated the fox to be a natural host of the tapeworm and that foxes may be infected to a much greater extent than are dogs. Support is lent to this

Fig. 2—*Taenia ovis*. This tapeworm occurs in the intestines of the dog, fox and allied species. The larval form is known as *Cysticercus ovis* and is found in the heart muscle and diaphragm of the sheep. (U.S.D.A.)

view by the fact that the fox frequently kills young lambs, devouring the tongue and muscular tissues, and in the light of this evidence it has been suggested that the fox may be a much more important factor in the dissemination of *C. ovis* infection in sheep than is the dog. It is possible in some localities that the dingo and wild dog may play a similar role and if this is the case, the control of the parasite can no longer be regarded as a practical procedure and it will be effective only to the extent to which the destruction of foxes and similar vermin is possible.

CYSTICERCUS TENUICOLLIS — THE THIN-NECKED BLADDER WORM

Cysticercus tenuicollis occurs principally in the adbominal cavity and is commonly observed at abattoirs, and in sheep killed for ration purposes. The cyst consists of a thin-walled bladder one to two inches in diameter containing clear watery fluid and may be observed hanging from the omentum and mesenteries (abdominal membranes), when the body cavity is opened. The tapeworm head appears as a white opaque spot in the wall of the cyst. Usually not more than three or four cysts are present in an affected sheep but occasionally, as the result of a gross infestation, hundreds of cysts are found scattered throughout the abdominal cavity and at times partially embedded in the liver tissue. In addition to the sheep, *C. tenuicollis* may be found in cattle, pigs and goats. The parasite is of no importance to human health but is sometimes confused with the *Echinococcus* or true hydatid cysts, particularly when embedded in the liver.

The adult tapeworm is known as *Taenia hydatigena* and is found in the small intestine of the dog where it may attain a length of 16ft. The life history of the parasite is similar to that described for *T. ovis*. Upon reaching the liver the embryo leaves the blood vessels and penetrates the liver tissues in which it wanders until it reaches the surface of that organ which it penetrates to enter the abdominal cavity and attach itself to the adbominal membranes. Here further development takes place which finally results in the development of the typical bladder-like cyst.

Despite the damage to the liver tissues caused by the migrating embryos, affected sheep suffer no ill effects, the presence of the infection only becoming apparent during examination at the time of slaughter. Since the parasite is of little economic importance and of no importance in relation to human health, the application of measures for its control are rarely warranted but should they be contemplated they would follow the lines described for the control of *C. ovis*.

ECHINOCOCCUS GRANULOSUS—THE HYDATID CYST

Echinococcus or hydatid cysts are found in the lungs and liver and occasionally in other tissues and organs, and they vary in size from a quarter of an inch to six inches or more in diameter. The cyst is enclosed in a firm fibrous capsule laid down by the body tissues and is lined by a delicate membrane from which tapeworm heads grow. It is filled with clear watery fluid and contains minute objects resembling grains of sand attached to the cyst wall or floating in the fluid. These are brood capsules each of which contains a number of tapeworm heads. In addition to the sheep, hydatid cysts occur in cattle, pigs, other animals and man. In the sheep, which is the natural host of the parasite, the majority of the cysts are fertile whereas in cattle the cysts are usually sterile and contain no living tapeworm heads, and this is also the case in about 20 per cent of the cysts occurring in pigs.

The parasite has a wide distribution and is especially prevalent in sheep-raising countries where hydatid cysts are common both in animals and man. In certain areas of Victoria and New South Wales from 20 to 30 per cent. of sheep and cattle examined have been found to be infected, while in New Zealand an even higher incidence than this has been recorded. The incidence of infection is much lower in Western Australia. At the Midland Junction abattoirs where all animals are subjected to postmortem inspection at the time of slaughter, the records for the year 1943 and 1944 show that less than two per cent. of the sheep examined were infected with hydatid cysts. The figures for cattle and pigs were correspondingly low, being less than 0.5 per cent., in the former and less than 0.25 per cent. in the latter.

During the course of meat inspection at abattoirs, organs such as lungs and livers containing hydatid cysts are condemned and subsequently destroyed and since the cysts do not usually occur elsewhere in the body, condemnation of the carcase is rarely necessary. Infected sheep appear to suffer no ill effects from the presence of the cyst; even massive infections causing extensive damage to the liver tissues are usually only detected during inspection of the abattoirs.

Life History.

The adult tapeworm occurs in the intestine of the dog and allied species such as the dingo fox. Unlike the other tapeworms described, it is extremely small, rarely exceeding a quarter of an inch in length and containing only two or three segments. On account of its small size and the fact that dogs rarely show any symptoms of the infection, the presence of the parasites is generally overlooked.

The life history of *Echinococcus granulosus* is similar to that described for *T. ovis*. Tapeworm eggs voided by infected dogs are swallowed by sheep while grazing and upon reaching the intestine the shell is digested and an embryo is liberated. The embryo penetrates the bowel wall gaining access to the blood vessels by which means it is carried to the liver or lungs where it becomes arrested. Here the embryo continues to grow developing after a period of several months into an *Echinococcus* or hydatid cyst. Dogs become infected by the consumption of raw offal containing the cysts.

Infection of Man.

The importance of the parasite lies chiefly in its relation to human health; tapeworm cysts located in the liver, less frequently in the lungs and sometimes in the bones causing hydatid disease, a serious and sometimes fatal condition in man. In Western Australia hydatids is not a notifiable disease under the Health Act and consequently the incidence of infection in human beings is unknown. Statistics, however, show that a small number of deaths have occurred annually from the condition.

As in the case of the sheep and other animals, infection in man results from ingestion of tapeworm eggs passed out by infected dogs. The risk of infection is greatest from contact with dogs kept at slaughter houses or on farms and stations where they are able to gain access to raw offal. In cities and large town where a system of meat inspection exists resulting in the condemnation and destruction of diseased organs, the risks of infection are remote.

The principal risk lies in the handling and fondling of infected dogs. Dogs kept on the chain or confined in yards, pass

their droppings in the vicinity of the kennels, and these eventually disintegrate and become mixed with the dust which may contaminate with tapeworm eggs. The risk of infection from the handling of dogs kept under such conditions is apparent, particularly when the precaution of washing the hands is overlooked. The danger is greatest in children who have no knowledge of hygiene. The majority of infections are belived to occur during childhood but these often do not become apparent until adult life.

Other methods of infection include the consumption of raw vegetables such as lettuce contaminated by tapeworm eggs derived from the excretions of dogs, or of water similarly contaminated, but these are considered to be of minor importance.

Prevention of Infection.

Since hydatid disease in man results from the ingestion of tapeworm eggs voided by infected dogs, particular attention should be directed towards the prevention of infection in those animals. Raw offal such as livers, lungs and hearts should never be fed to dogs and provision should be made for the sterilisation of such material by boiling, so as to destroy the parasites. In addition dogs should be regularly treated with arecoline hydrobromide for the removal of tapeworms. Dogs while under treatment, should be chained until purgation has ceased, when the droppings which may contain large numbers of ripe segments and eggs, should be collected and burned. Similarly dog yards and kennels should be maintained in a clean condition, droppings and bedding being regularly collected and destroyed by burning.

The precaution of washing the hands after handling dogs should never be neglected and this is particularly necessary before partaking of meals. Children require particular supervision in this connection. Young children should not be allowed to play with dogs or in the vicinity of their kennels. Dogs should be excluded from rooms in which food is being prepared or stored. Raw vegetables such as lettuce should be thoroughly washed in running water before use and dogs should be excluded from vegetable gardens. If the drinking water is drawn from a doubtful source it should be boiled before use.

These precautions should be practised in country districts, but they should not be necessary in cities and large towns where an efficient system of meat inspection exists.

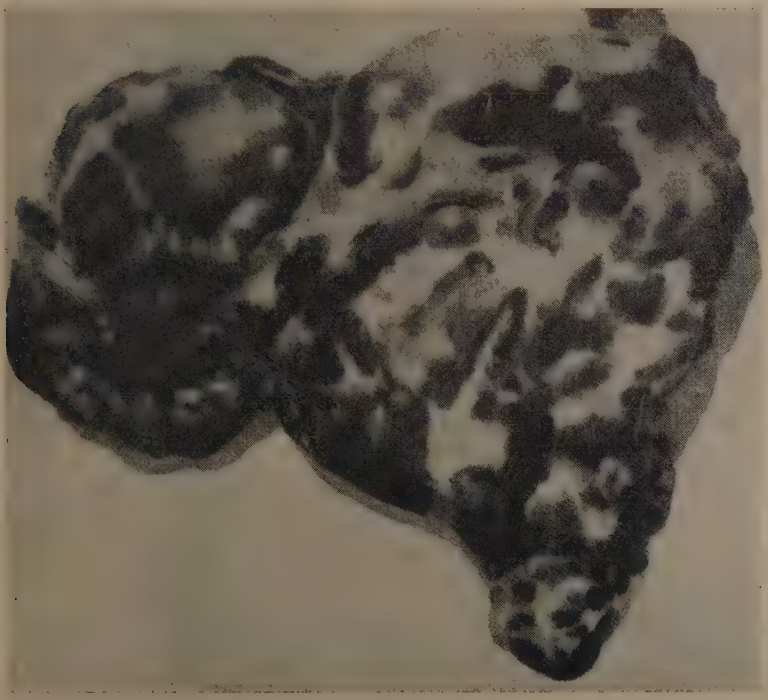

Fig. 3 — Hydatid cysts *(Echinococcus granulosus)* in liver of sheep. (U.S.D.A.)

Extract from C.S.I.R. Forest Products News Letter No. 166.

KNOW YOUR TIMBERS

Karri

Habit.

Karri is one of the giant trees of Australia reaching a height of 270 feet with a clean bole of 100-140 feet. The diameter at the butt may exceed 9 feet. The tallest karri measured has a height of 281 feet and is still standing. It is a magnificent tree with a smooth clean gum-type bark carried the full length of its straight, shapely trunk; the very thick bark is of a yellowish-white colour, blotched with pale to dark bluish patches. Karri regenerates readily after milling and the rate of growth is fast. At present 25,000 acres of cut-over forest have been given treatment for regeneration and placed under complete fire protection.

Timber.

The timber of karri is reddish-brown, closely resembling jarrah in appearance, although generally lighter in colour. Growth rings are not well defined and a wavy or striped figure due to interlocked grain is often shown. Karri can be distinguished from jarrah by the burnt splinter test, the former giving a white ash after burning, whereas jarrah burns slowly to a black char.

Karri is moderately heavy in weight, having a green density of 73 lb. per cubic foot, and when dried to 12% moisture content has a range from 49-62 lb. per cubic foot, with a mean density of 57.4 lb. per cubic foot, before reconditioning. In drying from the green condition to 12% moisture content the average shrinkage, before reconditioning of a backsawn board, is 10% (tangential shrinkage) and average shrinkage before reconditioning of a quartersawn board is 4.9% (radial shrinkage). Reconditioning only reduces these averages to 9.5% and 4.6% respectively, showing that very little collapse takes place.

Seasoning.

Karri requires more care in seasoning than does jarrah, since it dries more slowly and has a much greater tendency to check. Occasionally fine ring checks occur as well as the usual ray checks. Thicknesses up to 2 inches can be kiln-dried from the green condition, but the considerable care required, the strict control of drying conditions, and the fairly long period required for drying would, in most cases, make this practice uneconomical. Good results may be obtained by partially air-drying prior to kiln-drying, particularly if protection and shielding of drying stacks is given during periods of warm and dry weather. The seasoning schedule used for jarrah is applied to karri.

Relatively slight collapse occurs, and reconditioning is not generally practised, but it provides the advantages of making the timber milder for dressing and giving slightly larger sizes. Approximately four weeks are required to kiln-dry 1 inch green stock.

Mechanical Properties.

Karri is both stiffer and tougher than jarrah and has been included in Strength Group "B" together with spotted gum and Sydney blue gum. At 12% moisture content karri has an average modulus of rupture of 20,600 lb./sq. in. compared with 15,900 lb./sq. in. for mountain ash and 14,800 lb./sq. in. for jarrah. In compression parallel to the grain karri has an average value of 10,500 lb./sq. in. compared with 9,700 lb./sq. in. for mountain ash at 12% moisture content. Karri is tougher than jarrah, having a toughness value when dry of 245 in. lb. compared with 110 in. lb. for jarrah.

General.

Karri, together with such timbers as blackbutt, southern blue gum, messmate, stringybark and red mahogany, is classified in durability class 3 and the sapwood is immune to Lyctus attack. It is fairly difficult to work and the grain has a tendency to rise; nevertheless with care it can be finished well and highly polished. It bends well at a radius of 6 inches after a minimum steaming period of one hour per inch thickness. Backsawn and quartersawn material have been found to bend equally well if free from checks, but selection requirements are more stringent with backsawn than with quartersawn stock. The bark of karri has a tannin content which varies from 11 to 22% and gives a leather of a good light colour. There are certain difficulties associated with the extraction process and these have been studied by the Division of Forests Products. The bark, if not dried soon after falling, undergoes a change which is not fully understood, whereby some of the tannins become insoluble. It was, however, found possible to obtain yields of 90-95% of the total tannin present by the use of sodium bisulphite in extraction. There seems to be a definite possibility in this material as a basis for tannin extraction since karri bark could be made available at large mills in sufficient quantities to justify the erection of extraction plants.

Uses.

This timber is well known overseas as well as in Australia for its valuable qualities. It is popular for superstructures because of its great strength, its availability in large sizes and long lengths, and its comparative freedom from defects. It is widely used in wharf and bridge structures.

In railway workshops it is used for waggon, van and carriage construction. It is largely used in agricultural implements, especially for bent parts. It is also used in shipbuilding and as mine lift guides in South Africa, and for crossarms in Great Britain. In dwellings it is used for rafters, studs, joists, flooring, interior trim for furniture. It is used largely in Western Australia for export apple cases and when treated, for wooden pipe lines. It can be rotary cut or sliced to provide a very good veneer and plywood, and these products are available commercially. Tests at the Division of Forest Products have shown that karri glues satisfactorily with casein, urea and tego resin film glues. Sleepers treated with preservative, have been found eminently suitable when used in dry climates.

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Country Branches at Merredin and Narrogin

STOCK DISEASES CONTROL BY CORRESPONDENCE

By J. SHILKIN, B.V.Sc., Senior Veterinary Surgeon

THERE is a time honoured legend that the following letter was received by a Government Veterinary Surgeon, "Dear Sir, my horse is sick what shall I do? I trust you will be able to reply by return mail as I am very worried. Yours faithfully, John Smith." While this story may or may not be entirely true it is at least very close to the truth as many veterinarians can testify.

Letters are continually being received by the Department of Agriculture seeking advice regarding the diagnosis and treatment of sickness or disease in animals. While diagnosis of ill-health is often difficult enough when the animal concerned is in a position to be examined thoroughly by a veterinarian, the difficulties are greatly increased when diagnosis is attempted per medium of a letter and still more, when virtually no information other than that the animals are sick is given in such letters.

The assistance that officers of the Veterinary Branch can give in regard to preventive measures or remedial treatment is dependent upon a diagnosis that is as accurate as possible. If the information supplied is scanty or almost negligible, it is practically impossible to make an accurate diagnosis.

If this position is to be improved then the farmer will want to know what information is likely to be required.

As disease is really only any departure from normal health it is necessary to know what the animal or animals were like when in normal health. The information should therefore include breed, colour, age, sex and condition. In the case of a single animal, temperament may be important and if a female whether pregnant and the duration of pregnancy should be stated. In writing about a dairy cow say when she last calved and how much milk she is giving; with sheep say when last shorn and indicate the length and type of wool carried.

Symptoms should then be described. In the case of wounds, swellings or abscesses indicate their position and shape, whether hot, painful, soft, hard or bony, attached to, or movable under, the skin or whether an impression made by pressing firmly with the finger remains after the finger is removed. With wounds always give their size, shape, depth and the angle to the ground of long cuts. A simple sketch may often be valuable.

Describe carefully any abnormality in the posture of the animal or any of its organs. For example the third eyelid may protrude further over the eye than is normal. Discharges from the eyes, nose, mouth, vagina etc., should be mentioned together with some reference to the type of discharge, e.g. watery, blood-stained, or containing pus.

Any apparent pain should also be mentioned as well as any abnormality in the action of the bowels. Whether the respiration, that is the rate of breathing, is regular or irregular should be stated together with any coughing if noticed.

Following as much in the way of symptoms as can be given the history of course of the complaint should then be detailed. Information required comprises the surroundings of the animal or animals, the weather, food, date when symptoms were first noticed and the course taken by the disease up to the time of writing. Details of any treatment carried out should also be stated.

If writing about animals that have died, the results of any post-mortem examina-

tion that may have been carried out are likely to be valuable but only if carried out fairly soon after death.

Additional details that may be helpful where numbers of animals are involved are the date the first animal became affected and if possible the dates on which subsequent animals were found to be sick or dead, the total number affected, the number of deaths and the number of animals in the flock or head concerned. Always mention if any animals had been introduced prior to the outbreak and if so how long before the first case occurred.

The information required, therefore, is briefly:—

(1) Description of the animal or animals.

(2) All abnormalities.

(3) Course of the disease.

(4) Treatment, if attempted.

(5) Details of any post-mortem examinations carried out.

(6) In outbreaks, numbers and dates.

Information along these lines would certainly make it easier for Departmental officers to reply to letters of inquiry and enable the Department to perform a more useful advisory service where it has to be carried out by correspondence.

(From a broadcast talk, republished by courtesy of the Australian Broadcasting Commission).

NEW MILKING MACHINE SERVICE

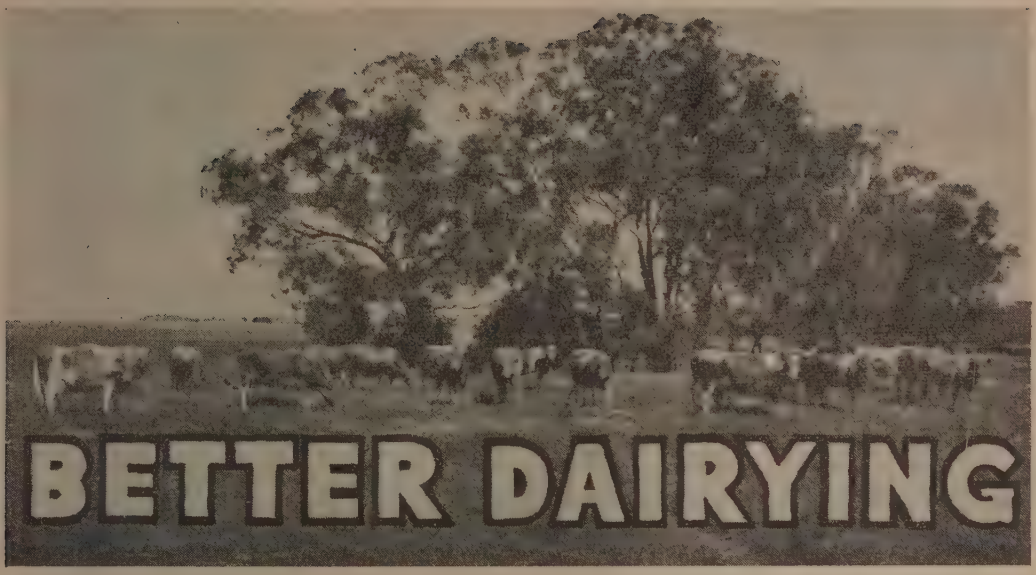
The Superintendent of Dairying (Mr. M. Cullity), recently reported on a new service for testing the efficiency of operation of milking machines which is being introduced in Western Australia.

For some time, he said, work being carried out by the Ruakura Research Institute, New Zealand, on the operation of the milking machine, has been followed with great interest, particularly in view of the emphasis placed upon correct milking procedure by overseas workers.

Several years ago a standard vacuum gauge was used to check those installed on several machines throughout the dairying districts when it was demonstrated the latter were not reading correctly. Approval was later granted under the Commonwealth Dairy Extension Grant to procure a vacuum recorder and an airflow meter as designed by the Ruakura research team. These have recently come to hand and are being used in a preliminary survey of machines in the dairy districts.

Mr. G. W. R. Scott, Dairy Instructor, during visits to country districts to inspect the work of Herd Recorders, is visiting three farms in each unit. The results so far achieved have demonstrated decisively that most of the machines need some adjustment, while many are being worked in a grossly inefficient manner. Mr. Scott's investigations will continue with his further visits to the country, and it is expected that his work will assist many farmers in improving the operation of their machines

On each visit, he makes a routine check of the operation of the machine, measuring the reserve air at various points, the operation of the vacuum pump, the effectiveness of the relief valve, and the operation of the pulsators. A report is left wth the farmer setting out the condition of the vacuum pump, the amount of reserve air compared to what it should be, the air consumption, whether satisfactory or not, any error in the vacuum gauge, the effectiveness of the relief valve, the pulsator readings and the adjustments which are recommended. At present it is not practicable to extend this service to all dairy farmers.



PLANNING A DAIRY FARM

By B. Williams, B.Sc. (Agric.), Agricultural Adviser

THE economic conditions obtaining in the dairying industry during the last few years have indicated clearly that any farmer wishing to ensure financial security must be efficient in his system of management and wise in his plan of development.

The ultimate success of a dairy farm, which combines a business and a family home, depends largely on such basic factors as:—

(1) The natural features of the land, soil type, contour, potential water supplies, rainfall.

(2) The cost of labour involved in production.

(3) The cost of materials involved in development and maintenance.

(4) The standard of living and comfort obtainable in the homestead, and the provision of adequate facilities and amenities for all members of the family.

The following points are worthy of consideration in the development and management of your farm. It must be realised that each farm is an individual problem; therefore no set design can be imposed directly on every holding; a plan of development must be modified to fit in with the existing features and the particular aims and requirements of the individual farmer.

Even in planning the development of a block of virgin country—and few properties are being developed from this state now—it would be necessary to fit the plan to the existing natural features so that a close inspection of the land and an appreciation of its potential fertility would be necessary in order to approach the problem intelligently.

Most farms with which we are concerned have reached a certain stage in development and it is from this stage that progress should be planned. How often have hasty decisions such as the placing of a fence, a shed or a culvert proved to be a constant source of annoyance and loss of time in later years? An orderly approach to development will assist in avoiding these mistakes.

The first essential is to draw up a master-plan of the farm as it is now. This should be done on a large sheet of paper or parchment and show, to scale, all fences, buildings, cleared land, timber, summer land, water points, contours, in fact, all features of importance.

Consider then how the farm could be best designed if it were possible to start afresh. These ideas will have to be modified according to those features which it is not possible or economical to change. Such things as the home site and other permanent features come to mind.

Enumerated below are some basic points which should be considered and considered with reference to your requirements. Study them carefully and then make a plan as you envisage the farm when fully developed. This plan may need modification at a later date but will aid in obtaining greater efficiency in the use of labour and materials, the two major costs in production today. Consider these points:—

The siting of the homestead and farm buildings. Usually a position in approximately the centre of the farm is desirable for convenient working. The dairy-shed and the house are the two key working units. Undue loss of time in travelling to and from these constitutes a hidden loss of income over each year.

Access roads. All parts of the farm should be easily and quickly accessible. How often have we seen good paddocks only partly used because of the difficulty of approach or the extra time involved. It is suggested that, where possible, each paddock should be independently accessible from the internal roads or raceways on the farm.

Roads should be designed with due regard to gradient and drainage so that they are usable in all weather conditions and will provide easy haulage for farm implements and vehicles. Gateways in particular require careful thought, especially when used frequently by stock, to avoid them becoming exasperating and frequently impassable bogs.

Roads and races should not be overwide. Fifteen to 20 feet is usually sufficient. The practice of making races one or two chains wide is wasteful of space, quite an important factor when the potential return may be 100 to 200 lb. butterfat per acre annually. Also wide races make it more difficult to handle stock and there is greater loss of time travelling from pasture to milking-shed and returning.

The position of gates is an important factor. Frequently gates in adjacent corners of adjoining paddocks, offset from the raceway, will provide easier approach to vehicles passing into the paddocks and also a turning point in the race.

Subdivision of the farm should be such that a grazing rotation of approximately three weeks could be carried out to ensure the maximum utilisation of feed in the flush period of the year.

Main fences should be of a permanent nature, as should also the main subdivisional fences. The size of individual paddocks however, can only be determined by the farmer himself with regard to his system of management and the class of stock he wishes to handle. Small areas where quick grazing is possible are beneficial from the point of pasture growth. They are, however, costly in fencing, water points and somewhat wasteful of land along the headlands as well as being uneconomical in cultivation.

It is not suggested that two, five or ten acres should be regarded as a satisfactory minimum size; a decision could be made only on a specific farm. It may be observed, however, that long, rather than square paddocks are easier to handle and the wise planner will consider the subdivision possible with an electric fence having due regard for the class of stock he will be holding. These temporary fences have proved to be very satisfactory in the South-West under a great variety of conditions. They are, however, not generally suitable for young calves or pigs unless special provision is made for them.

Frequently an economy in the provision of water points can be made with the electric fence and, together with the reduction in the amount of permanent fencing, there is appreciable saving. Rabbitproof boundary fences are essential in most districts.

Normally calf paddocks and pig pens should be constructed with permanent fencing. A number of small paddocks or pens are desirable to facilitate rotation. It may be noted, however, that the siting of these paddocks should be such that they are readily accessible from the main farm buildings, that drainage is adequate and away from other buildings, or any well or dam, and it is preferable to have them to leeward of the building group.

Water Supply. There is probably no other single factor on the farm in our South-West which has a greater influence on the utilisation of paddocks and the herd production than the provision of water. Much valuable grazing has been lost because stock, particularly milking stock, had too far to travel to water.

In preparing the fully-developed plan it is essential that suitable supplies of water be located and provision made for the reticulation to **all** parts of the farm. Pipes, tanks, and troughs are expensive but when one water-point frequently brings many acres into profitable use they are economical to install. A well designed reticulation system will save many pounds in installation costs and raise the level of fertility over the whole farm by facilitating the proper rotation of stock and crops.

Of recent years the immense value of small farm irrigation systems has been very clearly demonstrated on many farms. Any potential dam site is worthy of consideration in the plan. Such a dam may provide irrigation for lucerne, fruit or vegetable crops or summer fodders and do much to reduce the adverse effect of our seasonal herbage growth on dairy cattle production.

As your farm is your business, every factor which will increase the efficiency of the labour used, or the stock and crops grown, should be considered in the final plan. Shelter belts, loading ramps, cattle pits, milk delivery points and a host of other features could be mentioned but the main purpose of this article is to stress the advantage of drawing up a proposed plan of your own farm under your own system of management. Adequate subdivision, accessibility and water reticulation to enable the efficient use of the labour available is the keynote of efficient development.

DOMESTIC FIREPLACES AND CHIMNEYS

An efficient chimney is an essential part of nearly every Australian dwelling and requires careful attention to its construction. The number of inquiries received by research bodies on the best method of building a chimney and on the means of dealing with defective chimneys indicates the need for reliable and easily available information on the principles involved and on practical recommendations for chimney construction.

Although little specific research has been done on the subject various authorities have made recommendations after examining efficient structures in the light of present-day knowledge of aerodynamics. The principles on which the chimney works are well known. Heated air from the fire expands, and being lighter than the surrounding colder air, rises, forming a current which takes the smoke and gases with it. As too great a draught would cause rapid consumption of the fuel, provision is made to limit the draught by means of a throat—the junction of flue and fireplace opening. The second main problem is that of returning smoke. This is prevented by good design, and allowances for pressure areas within and around the building.

Illustrated publications dealing with such aspects as site conditions, plan arrangements, and typical dimensions for fireplace opening and depth, throat, smoke shelf, and flue are—

DOMESTIC FIREPLACES AND CHIMNEYS—Notes on the Science of Building, NSB No. 31, published by the Commonwealth Experimental Building Station. Price, 9d.

SMOKY CHIMNEYS—Building Research Station Digest No. 18. Price, 6d.

These may be obtained from the Building Research Liaison Service, Box 2807 AA, Melbourne, and NSB 31 (only) from the Station, Box 30, CHATSWOOD, N.S.W. Prices include postage.

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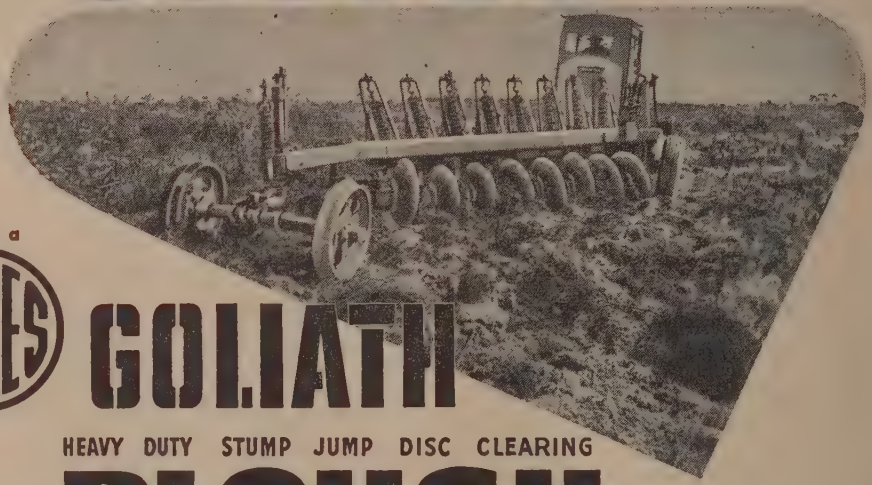

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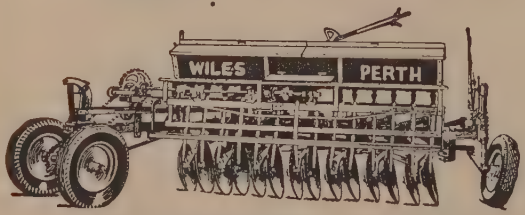

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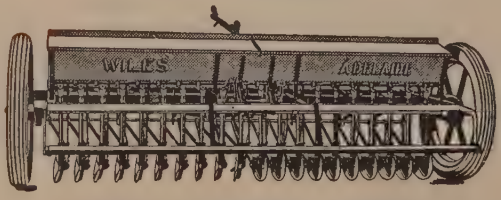

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